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COMPARATIVE EFFECT OF MULLIGAN MOBILIZATION VERSUS PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF) IN IMPROVING SHOULDER FUNCTION IN PATIENTS WITH ADHESIVE CAPSULITIS

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ABSTRACT

Objective: To compare effect of Mulligan Mobilization Versus Proprioceptive Neuromuscular Facilitation (PNF) In Improving Shoulder Function In Patients With Adhesive Capsulitis **Methods**: A randomized clinical trial study was conducted. Moeen Physiotherapy Clinic and Chiniot Hospital Faisalabad were study setting. Sample size was 30 calculated using G.power software. Study ran March 2023 to September 2023. Both men and women aged 40 to 60 who had frozen or stiff shoulders for at least two months were included. Having a fracture within the last 12 weeks, and having a dislocated shoulder and shoulder arthritis were excluded. Ethical consideration were followed throughout study. Two intervention groups were created Group B got Proprioceptive Neuromuscular Facilitation (PNF), while group A received Mulligan Mobilization. Data was gathered using numeric pain rating scale and shoulder pain and disability index. SPSS version 22 utilized for statistical analysis. **Results:** Showed NPRS scores post treatment was significantly greater in Mulligan group (3.430±1.104 than in PNF group (4.150±1.373, p=0.033). There were also significant differences in SPADI Pain and Disability scores, with a greater reduction in pain in the Mulligan group (21.423±6.038 vs. 25.423±6.038, p=0.013), and in disability (42.216±10.808 vs. 44.216±10.808, p=0.015). Mulligan group showed significant reduction (58.701±16.256 vs 57.701±16.256; p=0.010) in total SPADI score which suggests slightly better functional improvement in a Mulligan group. **Conclusion**: Both Mulligan Mobilization and Proprioceptive Neuromuscular Facilitation (PNF) showed effective interventions for improving pain and shoulder function but Mulligan Mobilization showed more significant results as compare to Proprioceptive Neuromuscular Facilitation (PNF).

KEYWORDS: Adhesive capsulitis, Frozen shoulder, Hold relax, Mulligan, Neuromuscular Facilitation**,** Proprioceptive.

INTRODUCTION

The condition known as frozen shoulder or "Adhesive capsulitis " is a familiar inflammatory illness that affects a large number of individuals. It causes pain and disability in the affected shoulder.[1] The first explanation for adhesive capsulitis was published by Codman in 1934. Later in 1945 Navisear revealed the synovial changes in the glenohumeral joint and coined the term adhesive capsulitis. It is a very prevalent condition that affects 2 to 5% of the overall population.[2,3] It affects

around 5% of people with a peak incidence occurring in people between the ages of 40 and 70. In 20–30% of instances it is bilateral and more prevalent in females.[4] There is variability in the worldwide occurrence and estimated range is 2% to 5%. Both men and women are affected and the cause is mostly unidentified.[5] There are limited statistics on the prevalence of adhesive capsulitis in South Asia. On the other hand the prevalence probably consistent with worldwide figure.[6] Within India it is estimated that people with diabetes mellitus.[7] have an 11% to 30% higher incidence of adhesive capsulitis compared to those without diabetes (2% to 10%). According to Pakistani statistic 38% of people have adhesive capsulitis with 28.07% of men and 45.70% of women affected.[8]

Twenty to thirty percent of Americans who have adhesive capsulitis in one shoulder are expected to develop it in the other shoulder as well, affecting two to five percent of the population.[9] Adhesive capsulitis had 4 phases. 1. Prefreezing: This first phase may last for two to nine months. Pain may start slowly and worsen over time especially at night2. Freezing: This phase usually lasts between six and twelve months. Even while at rest the discomfort becomes worse and more persistent. 3. Frozen: This phase may last for five to twenty-six months.[10] Subsequently there is a "freezing" phase that lasts for nine months during which the symptoms progressively become worse histologically there is collagen deposition and perivascular synovitis. "Frozen" stage lasts for 1-4 months is characterized by toughness as the main sign. In the last two phases the capsule's thick collagenous tissue forms and is linked to the creation of scars.[11] 4. Thawing: This last phase may take two years or six months to complete. Pain keeps becoming less as range of motion steadily increases.[12]

Despite the dearth of high-quality research showing that physiotherapy is superior to medication or observation alone, it has long been utilized to treat adhesive capsulitis. Positive outcomes have been seen when comparing the effects of intra-articular corticosteroid injections with physiotherapy.[13]

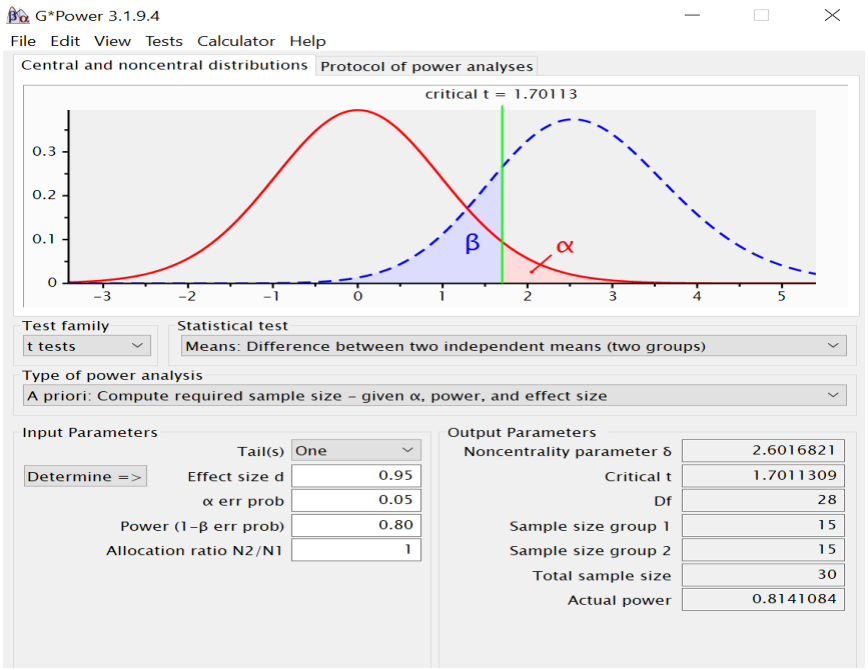
In cases with ACS physical therapy has traditionally served as the first line of therapy.[14] Griggs et al. demonstrated that about 90% of patients at 22 months had a good outcome from a supervised stretching program.[5,15]

Early in the 1950s Kabat and Knott invented PNF treatment strategy.[16] Flexion, abduction, and rotation are examples of the typical physiological joint motions that are done in a single plane during the general workouts. Rotational patterns of movement are one of the primary components of PNF, and all of its techniques are carried out in accordance with fundamental protocols. A variety of methods, including dynamic reversals, repetitive contractions, rhythmic stabilization, hold-relax, contract-relax, and combination isotonics, can be used to increase muscular strength and flexibility, respectively.[17] Post-isometric relaxation (autogenic inhibition), stress-relaxation, and reciprocal innervation are the neurophysiological foundations of hold-relax and contract-relax procedures.[18]

In 1999, Bryan Mulligan developed Mulligan mobilization, a technique that integrated Kalternborn's passive mobilization concepts. They are instructed to restore the decreased accessory glide in order to move painlessly. Peripheral musculoskeletal problems can be treated using similar concepts, which are known as While the therapist applies a continuous auxiliary glide at right angles or parallel to the joint, mobilization with movement and restricted painful physiological movement are actively done. By guiding the joint through its natural physiological motion, the accessory movement has been shown to address shoulder malalignment, reducing discomfort and increasing range of motion.[19] The goal of Mulligan's approach for peripheral joints is to realign bone positional defects with concurrent physiological (osteo-kinematic) forces by applying a continuous hand "gliding" force to a joint. joint motion, which can be done passively by the therapist or actively by the patient. It has been demonstrated that Mulligan's method can change sympathetic nervous system function and have simultaneous hypoalgesic effects both during and after use.[20]

MATERIAL AND METHODS

This randomized clinical trial Was conducted on 30 participants having adhesive capsulitis sample size calculated using G power used previous article as reference.[21]

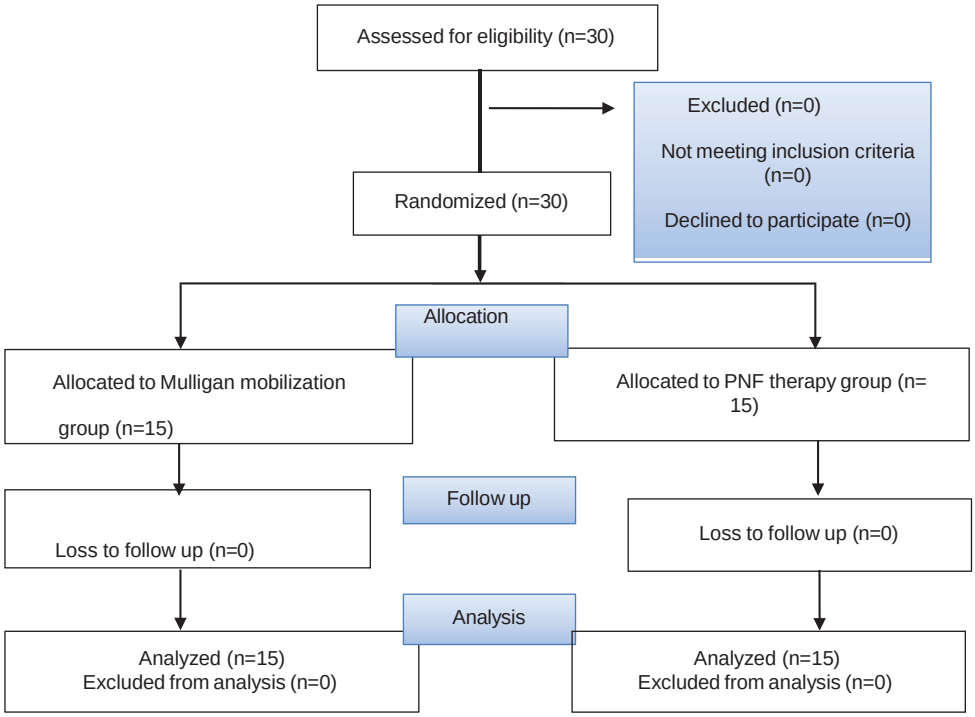


Both men and women aged 40 to 60 who had frozen or stiff shoulders for at least two months were included. Having a dislocated shoulder, shoulder arthritis and having a fracture within the last 12 weeks were excluded.[22] Non probability convenience sampling technique was used for data recruitment. Moeen Physiotherapy Clinic and Chiniot Hospital Faisalabad were study setting. Study ran March 2023 to September 2023. Data was equally randomly allocated to both groups. 2 intervention groups were made group A received Mulligan Mobilization and group B undergone Proprioceptive Neuromuscular Facilitation (PNF) 3 session per week upto 4 weeks. Data was gathered using numeric pain rating scale and shoulder pain and disability index.

Static analysis

The data was analyzed using the Statistical Package for the Social Sciences, version 22. Normality test showed P > 0.05 indicating data was normally distributed by Shapiro-Wilk test. The independent sample t test was employed for comparisons between groups. The between-group analysis was conducted using the paired sample t test.

Consort diagram



RESULTS

Table 1: Demographic Information of study participants.

		Treatment Group			Total
		Group A (Mulligan)		Group B (PNF)	
		Mean ±SD		Mean ±SD	Mean ±SD
Age		45.802±3.188		45.903±3.194	45.867±3.164
Height in feet		5.353±.238		5.378±.296	5.395±.267
Weight in Kg		67.833±13.125		65.000±10.020	65.917±11.618
BMI		25.614±4.076		23.431±2.748	24.029±3.501
		Frequency	%	Frequency	%
Gender	Male	15	50.0%	15	50.0%
	Female	14	40.0%	16	60.0%
Affected Side	Right	17	56.7%	13	46.7%
	Left	13	43.3%	17	53.3%

Patients of Mulligan and PNF group had 45.802±3.188 and 45.903±3.194 years of mean age while the overall mean age of patients was 45.867±3.164 years. The mean height in the Mulligan and PNF groups was 5.353±0.238 feet and 5.378±0.296 feet, respectively, and mean weight was 67.833±13.125 kg and 65.000±10.020 kg, respectively. The average BMI in Mulligan: 25.614±4.076 and in PNF. 23.431±2.748. For gender distribution, half of the subjects were males in both groups (50% in both groups), and females were greater in percentage among PNF group (60%). The right side was involved in 56.7% of participants in the Mulligan group compared to 46.7% in the PNF group.

Table 2: Between groups comparison using Independent Sample t test.

		Treatment Groups		Independent Sample T-test	
		Group A (Mulligan)	Group B (PNF)		
Outcome Measure	**Assessment**	**Mean ±SD**	**Mean ±SD**	**Mean Difference**	**P value**
NPRS	Pre treatment	5.833±1.683	6.030±1.564	.100	.634
	Post treatment	3.430±1.104	4.150±1.373	.72	.033
SPADI Pain	Pre treatment	36.766±6.468	39.933±6.741	-0.800	.629
	Post treatment	21.423±6.038	25.423±6.038	3.813	.013
SPADI Disability	Pre treatment	67.356±11.550	67.356±11.550	0.143	.508
	Post treatment	42.216±10.808	44.216±10.808	2.967	.015
SPADI Total	Pre treatment	97.123±17.643	97.123±17.643	0.533	.598
	Post treatment	57.701±16.256	58.701±16.256	1.800	.010

For NPRS, the pre-treatment pain was not substantially different (5.833±1.683 in Mulligan and 6.030±1.564 in PNF, p=0.634). But after treatment, the pain reduced to a larger extent in the Mulligan group (3.430±1.104) than in the PNF group (4.150±1.373), and the mean difference was significant at 0.72 (p=0.033).On the SPADI Pain, pre-treatment PNF group scores were nominally higher than in the Mulligan group (39.933±6.741 v 36.766±6.468, p=0.629). On treatment, pain score decreased in both groups but a group difference was statistically significant in favor of the Mulligan group (p=0.013).

For SPADI Disability, pre-treatment values were nearly identical in both the groups (67.356±11.550, p=0.508). Post-treatment, the two groups showed improvement but with more decrease in the Mulligan group (42.216±10.808) than in the PNF group (44.216±10.808), mean difference of 2.967 (p=0.015).

Total SPADI score was also similar, with pre-treatment scores of both groups almost the same (97.123±17.643, p=0.598). At post-treatment, Mulligan group showed slightly improved improvement (57.701±16.256) as compared to PNF group (58.701±16.256) by a mean of 1.800 (p=0.010).

Table 3: Within group comparison Paired Sample t test.

		Assessment		Paired Sample T-test	
		Pre treatment	Post treatment		
Outcome Measure	**Groups**	**Mean ±SD**	**Mean ±SD**	**Paired Difference**	**P value**
NPRS	**Group A (Mulligan)**	6.030±1.564	4.150±1.373	2.400±1.003	<.001
	Group B	5.833±1.683	3.430±1.104	2.933±.944	<.001

	(PNF)				
SPADI Pain	**Group A (Mulligan)**	39.933±6.741	25.423±6.038	15.666±5.201	<.001
	Group B (PNF)	36.766±6.468	21.423±6.038	15.333±5.548	<.001
SPADI Disability	**Group A (Mulligan)**	67.356±11.550	44.216±10.808	23.000±8.485	<.001
	Group B (PNF)	67.356±11.550	42.216±10.808	25.100±8.595	<.001
SPADI Total	**Group A (Mulligan)**	97.123±17.643	58.701±16.256	39.100±11.798	<.001

In Numeric Pain Rating Scale (NPRS), both groups reported statistically significant reduction of pain after treatment. The Mulligan group improved from 6.030±1.564 to 4.150±1.373 (mean difference: 2.400±1.003, p <.001), and the PNF group improved from 5.833±1.683 to 3.430±1.104 (mean difference: 2.933±.944, p <.001). Pre-treatment scores in SPADI Pain for Mulligan group were 39.933±6.741 and 36.766±6.468 for PNF group. Both the groups after treatment improved with differences of mean value 15.666±5.201 in Mulligan and 15.333±5.548 in PNF (p <.001). For SPADI Disability, the Mulligan group dropped from 67.356±11.550 to 44.216±10.808 (mean difference: 23.000±8.485, p <.001), and the PNF group dropped from 67.356±11.550 to 42.216±10.808 (mean difference: 25.100±8.595, p <.001).

The SPADI Total score was also parallel to this, with both groups experiencing the same reductions. The Mulligan group decreased from 97.123±17.643 to 58.701±16.256 (mean difference: 39.100±11.798, p <.001), and the PNF group decreased from 97.123±17.643 to 57.701±16.256 (mean difference: 40.433±13.612, p <.001).

DISCUSSION

Current randomized clinical trial study was conducted on 30 subjects having adhesive capsulitis. Study concluded both interventions having significant impact on improving shoulder function but mulligan group showed more superior results as compared to PNF group.

The between-group comparison of the Numeric Pain Rating Scale (NPRS) using an Independent Sample t-test showed the following results For NPRS, the pre-treatment pain was not substantially different (5.833±1.683 in Mulligan and 6.030±1.564 in PNF, p=0.634). But after treatment, the pain reduced to a larger extent in the Mulligan group (3.430±1.104) than in the PNF group (4.150±1.373), and the mean difference was significant at 0.72 (p=0.033) these finding were accordance to Razzaq A et al. study.[23]

The between-group comparison of SPADI Pain score, pre-treatment PNF group scores were nominally higher than in the Mulligan group (39.933±6.741 v 36.766±6.468, p=0.629). On treatment, pain score decreased in both groups but a group difference was statistically significant in favor of the Mulligan group (p=0.013) these results were compatible to Rana A et al. and Shrivastava et al. study results.[24,25]

Current study suggested that SPADI Disability, pre-treatment values were nearly identical in both the groups (67.356±11.550, p=0.508). Post-treatment, the two groups showed improvement but with more decrease in the Mulligan group (42.216±10.808) than in the PNF group (44.216±10.808), mean difference of 2.967 (p=0.015) these results were accordance to Noten S et al.[26]

Within group comparison showed Numeric Pain Rating Scale (NPRS), both groups reported statistically significant reduction of pain after treatment. The Mulligan group improved from 6.030±1.564 to 4.150±1.373 (mean difference: 2.400±1.003, p <.001), and the PNF group improved from 5.833±1.683 to 3.430±1.104 (mean difference: 2.933±.944, p <.001) these finding were consistent with Agarwal et al.[27]

The SPADI Total score was also parallel to this, with both groups experiencing the same reductions. The Mulligan group decreased from 97.123±17.643 to 58.701±16.256 (mean difference: 39.100±11.798, p <.001), and the PNF group decreased from 97.123±17.643 to 57.701±16.256 (mean difference: 40.433±13.612, p <.001) these results were accordance to Riaz et al. study findings.[28]

LIMITATIONS

Substantial BMI group differences may introduce bias and influence the outcome of treatment. Short follow-up period for only 12 treatment sessions in 4 weeks did not permit the estimation of functional gains at long term. The study was conducted at a single center on a small sample size, and as a result, generalizability of the findings is doubtful.

CONCLUSION

Both Proprioceptive Neuromuscular Facilitation (PNF) and Mulligan Mobilization as effective interventions for improving pain and shoulder function but Mulligan Mobilization showed more significant results as compare to Proprioceptive Neuromuscular Facilitation (PNF).

RECOMMENDATIONS

Cognitive and psychological processes must be examined in order to ascertain the influence on sensory-motor rehabilitation of patients with adhesive capsulitis/comparison trials of other forms of physiotherapy must be conducted.

To ascertain the most effective therapy for enhancing the mobility and function of the shoulder.

Incorporating objective measurements of outcome such as imaging or biomechanical assessment will allow for a more accurate measure of the efficacy of treatment

AUTHORS' CONTRIBUTIONS

Dr kanwal Fatima contributed to the conception, study design, and data collection. Zarish Younas contributed to data analysis and interpretation, and Dr. Maria Amjad contributed to article drafting and proofreading. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

The study received approval from the Institutional Review Board of "Government college university Faisalabad" on September 9, 2023.

DECLARATION OF PARTICIPANT CONSENT

The authors attest to having acquired all necessary consent forms from participants. The participants have consented on the form to the journal's publication of their photos and other clinical data. The participants are aware that while every attempt will be made to hide their identities, anonymity cannot be guaranteed. Their names and initials will not be published.

USE OF ARTIFICIAL INTELLIGENCE

The authors confirmed that no artificial intelligence (AI)-assisted technology nor AI-manipulated pictures were used to help with the manuscript's composition or editing.

CONFLICTS OF INTEREST

No conflict of interest.

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