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COMPARATIVE EFFECT OF SPENCER TECHNIQUE VERSUS MULLIGAN'S TECHNIQUE FOR SUBJECTS WITH FROZEN SHOULDER – A SINGLE BLIND STUDY

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ABSTRACT

Background and Objective: Among many interventions for subjects with frozen shoulder, mobilization techniques are the important techniques of intervention. However the opinions about efficacy of mobilization techniques differ. Hence, the purpose of this study to compare the effectiveness of Mulligan's mobilization with movement with that of Spencer technique on improving pain, abduction and external rotation ROM and functional disability in subjects with frozen shoulder.

Method: An experimental study design, 40 subjects with unilateral frozen shoulder were randomized into 2 groups with 20 subjects each in Mulligan and in Spencer group. Subjects in Mulligan group received Mulligan mobilization with movement (MWM) and subjects in Spencer group received Spencer technique and conventional exercises was given for both the groups. The duration of intervention was one treatment sessions per day for five days. Outcome measurements such as pain using VAS, shoulder abduction and external rotation ROM using goniometer and functional disability using SPADI were measured before and after five days of intervention.

Results: Analysis using paired 't' test and wilcoxon signed rank test found that there is a statistically significant improvement ($p < 0.05$) in pain, shoulder mobility and functional disability within the groups. Comparative analysis using independent 't' test and Mann Whitney U test found that there is no statistically significant difference in improving pain between MWM and Spencer group. However MWM group found significantly greater improvement in shoulder mobility and functional disability comparative with Spencer technique.

Conclusion: It is concluded that both MWM and Spencer technique are shown to have short term effect on improving pain, shoulder mobility and functional disability. However, MWM was found clinically more effective with greater percentage of improvement on improving shoulder abduction, external rotation ROM and functional disability than Spencer technique in subjects with frozen shoulder.

Key words: MWM, Mulligan's mobilization, Spencer technique, frozen shoulder, pain, shoulder mobility, functional disability, mobilization, adhesive capsulitis, periartthritis.

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INTRODUCTION

Frozen shoulder or Adhesive capsulitis is characterized by painful, gradual loss of active and passive shoulder motion resulting from fibrosis and contracture of the joint capsule.¹ It is a condition of unknown etiology characterized by gradually progressive, painful restriction of all joint motions with spontaneous restoration of partial or complete motion over months to years.² It occurs in 2-5% of the general adult population and up to 20% of the patients with diabetes, mainly affects individuals of 40-60 years of age with female predominance.³

Treatments advocated for adhesive capsulitis include physiotherapy interventions such as heat application, ultrasound, interferential treatment, stretching, exercises,⁴ mobilization and manipulative treatment options that includes high velocity, low amplitude manipulation, end range mobilization, mid range mobilization, Spencer technique and mobilization with movement of the shoulder.⁵

The Spencer technique is a standardized series of shoulder treatments with broad application in diagnosis, treatment and prognosis. It is developed by Spencer, D.O. in 1916. The evolution of this technique is traced from 1916 to date to try to identify factors in the development of manipulative methods.⁶ This approach is a well known osteopathic manipulative technique that focuses on mobilization of the glenohumeral and scapulothoracic joints. It helps the restricted joints to improve their function, as well as positively affect other emotional, social and cognitive areas.⁷ Spencer technique is an articulatory technique with seven different procedures used to treat shoulder restriction caused by adhesive capsulitis. In this technique passive, smooth, rhythmic motion is designed to stretch contracted muscles, ligaments and capsules. Most of the force is applied at the end range of motion. This technique increases pain free range of motion through stretching the tissues, enhancing lymphatic flow and stimulating increased joint circulation.⁸ Studies have shown the effect of Spencer technique on improving mobility and functional ability in subjects with frozen shoulder.⁸⁻¹¹

The Mobilizations with movement (MWM) for peripheral joints has been developed by Mulligan. MWM can be used in isolation or integrated with other manual approaches to improve the quality of joint intra articular gliding, neurodynamics and the facilitation of correct muscle recruitment. It is a combination of an active movement with simultaneous passive accessory mobilizations, to achieve painless movement by restoring the

reduced accessory glide. In essence, the limited painful physiological movement is performed actively while the therapist applies a sustained accessory glide at right angles or parallel to the joint to restore a restricted, painful movement to a pain free and full range state. The combination of joint Mobilization with active movement may be responsible for the rapid return of pain free movement.¹² It was stated that mechanisms behind the effectiveness of MWM are based on mechanical dysfunction and therefore positional fault correction. This concept is related to positional faults that occur due to injury or changes in the shape of articular surfaces, thickness of cartilage, orientation of fibres of ligaments and capsules which lead to maltracking of the joint, resulting in symptoms such as pain and stiffness. MWM corrects this by repositioning the joint causing it to track normally. Research has established the effectiveness of MWM in improving mobility and functional abilities in subject with frozen shoulder.¹³⁻¹⁷

Studies have shown that both the Spencer Technique and MWM are used effectively in the treatment of frozen shoulder. However there are no studies found in the literature which compare the effects of these two methods of Manual therapy. The present study with research question whether there is any difference between spencer technique versus mulligan's technique on improving pain, mobility and functional disability in subjects with frozen shoulder. Hence, the purpose of the study is to compare the effectiveness of the Spencer technique versus Mulligan's technique on improvement of pain, mobility and functional ability for subjects with frozen shoulder. It was null hypothesized that there will be no significant difference in effect of Spencer technique versus Mulligan's technique on improvement of pain, mobility and functional disability in subjects with frozen shoulder.

METHODOLOGY

An experimental study design with two groups- Spencer Group and Mulligan's Group. As this study involved human subjects the Ethical Clearance was obtained from the Ethical Committee of KTG College of Physiotherapy and K.T.G. Hospital, Bangalore as per the ethical guidelines of Bio-medical research on human subjects. This study was registered for subject for registered for dissertation with Rajiv Gandhi University of Health Sciences with registration number 09_T031_47178. Subjects included were both male and female with age group between 40 to 60 years, unilateral primary adhesive capsulitis,¹⁸ painful stiff shoulder for at least 3 months,¹⁸ with more than 50% loss of

passive movement of shoulder joint compared to the unaffected side.¹⁸ Subjects were excluded with recent history of surgery on particular shoulder, Rheumatoid arthritis,¹⁸ history of fracture around shoulder complex, Diabetes Mellitus, Osteoporosis or malignancies in the shoulder function,¹⁸ pain or disorders of cervical spine, elbow, wrist or hand,¹⁸ rotator cuff rupture and, tendon calcification. Subjects were recruited from KTG Multi Specialty Hospital and various rehabilitation centers across Bangalore. The study was conducted at KTG Multi Specialty Hospital, Bangalore. Subjects who meet inclusion criteria were recruited by Simple random sampling method using closed envelopes, randomly allocated subjects into two groups. Subjects who meet inclusion criteria, total 40 Subject (n = 40), 20 in each group, were informed about the study and a written informed consent was taken. Subjects were blinded throughout the treatment sessions, subjects from both the groups were not allowed to have any interaction to each other and the subjects were not aware of what kind of treatment they received and its effects. The duration of intervention was carried for one session per day for five days.

Procedure of intervention for Spencer group:

Subjects in this group were received Spencer technique for shoulder external rotation and abduction range of motion and conventional exercises under supervision.

Spencer technique.¹⁹

a. To increase the external rotation:

Circumduction with compression technique: The subject's elbow was flexed and shoulder was abducted to 90°. Subject's elbow was used as a pivot to rotate humerus clockwise and anti clockwise. Slight compression was applied on the glenohumeral joint. The concentricity of the circles was performed to the maximum tolerance of the subject. The procedure was repeated 8-10 times in clockwise and anticlockwise direction.¹⁹

Circumduction with traction technique: The subject's elbow was flexed and shoulder was maintained in abducted position. Traction force was applied on glenohumeral joint while rotating the humerus in clock wise and counter clock wise circles. The concentricity of the circles was performed to the maximum tolerance of the subject. This technique can also be done with elbow in extension position. The therapist held the subject's shoulder with his caudal hand and move the subject's arm in the same progressive concentric circles. The procedure was repeated 8-10 times in clockwise and anticlockwise direction.¹⁹

b. To increase the shoulder abduction technique:

The subject's elbow was flexed and the shoulder was abducted to 90°. Therapist held the elbow of the subject with one hand and shoulder with the other hand and exerted upward or cephalad pressure on elbow to increase abduction till the end range is felt and then the arm was brought back to the neutral position. The procedure was repeated for 8 to 10 times.¹⁹

Procedure of intervention for Mulligan's technique: Subjects in this group received Mulligan's Technique with Conventional Exercises.

Mulligan's Technique - The MWM technique was performed on the involved shoulder as described by Mulligan. The subject was in a relaxed sitting position. Mulligan belt was placed around the head of the humerus to glide the humerus head appropriately (posterolateral glide and inferior glide). With one hand the therapist held the belt in place sustaining the glide. A counter pressure was also applied to the scapula with the therapist's other hand. The patient was asked to perform slow active shoulder movements (external rotation and abduction) to the end of pain free range. The glide was sustained during the movement and released after returning to the starting position. The procedure was performed three sets of 10 repetitions, with 1 minute rest between sets. The same procedure was performed one session per day for five days.^{13, 20}

Conventional Therapy for both the groups: The subjects were made to do exercises within pain-free range under supervision. The exercises included were Pendular exercise, Isometric Scapular Retraction, Rotator cuff exercises, Scapular stabilization exercise- with exercise ball in upright standing position, Finger walk on a wall, Active-assisted ROM exercises – This involves the subject using the uninvolved arm or equipments such as rope, over-head pulley and wand. All the exercises were performed for all movements namely flexion-extension and abduction-adduction, one sets of each 10-15 repetitions within pain-free range. Subjects were instructed to carry their regular daily activities.



Figure-1: Circumduction with compression technique



2a: Starting Position 2b: Progression of the technique
Figure-2: Circumduction with traction



3a. Traction with abduction 3b. Progression of traction with abduction
Figure-3: Shoulder Abduction Technique



4a. Initial Position 4b. Progression of Technique
Figure-4: Mulligan's Mobilization for Shoulder abduction



5a. Initial Position 5b. Progression of Technique
Figure-5: Mulligan's Mobilization for External Rotation

Outcome Measurements:

The Subjects of both groups participated in the study were evaluated for outcome measurements such as pain using VAS (Visual analogue scale)²¹, Range of motion for shoulder abduction and external rotation were measured using goniometer^{22,23} and functional disability using SPADI (Shoulder pain disability index)^{24,25} prior to the treatment and again after five days of intervention.

Statistical Methods

Descriptive statistical analysis was carried out in the present study. Out Come measurements analyzed are presented as mean \pm SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Paired 't' test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change. Independent 't' test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between two groups with calculation of percentage of difference between the means. The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

The study was completed with total 40 subjects (Table-1). In Mulligan Group there were 20 subjects with mean age 50.40 years and there were 12 males 8 females were included in the study. In Spencer Group there were 20 subjects with mean age 50.85 years and there were 11 males 9 females were included in the study. There is no significant difference in mean ages between the groups.

In Mulligan Group (Table-2) there is a statistically significant change in means of VAS, SPADI, Shoulder abduction and external rotation AROM and PROM when means were analyzed from pre intervention to post intervention within the groups with $p < 0.000$ with negative percentage of change showing that there is decrease in the post means and positive percentage of change showing there is increase in post means. There is clinical significant improvement with large effect size. In Spencer Group (Table-3) there is a statistically significant change in means of VAS, SPADI, Shoulder abduction and external rotation AROM and PROM when means were analyzed from pre intervention to post intervention within the groups with $p < 0.000$ with negative percentage of change

showing that there is decrease in the post means and positive percentage of change showing there is increase in post means. There is clinical significant improvement with large effect size.

When pre intervention means (Table-4) of VAS, SPADI, Shoulder abduction and external rotation AROM and PROM were compared there is no statistically significant difference in VAS Score, SPADI pain, AROM External rotation, and PROM abduction between the groups and there is a statistically significant difference in SPADI

disability, SPADI Total, AROM abduction and PROM External rotation between the groups. When post intervention means (Table-5) of SPADI, Shoulder abduction and external rotation AROM and PROM were compared there is statistically significant difference in means between the groups. When post intervention means of VAS was compared there is no statistically significant difference in means between the groups. There is a moderate to large clinically significant difference in post means with medium and large effect size.

Table 1: Basic Characteristics of the subjects studied

Basic Characteristics of the subjects studied		Mulligan Group		Spencer Group		Between the groups Significance	
Total number of subjects studied (n)		20		20		--	
Age in years (Mean ± SD)		50.40 ± 5.42 (42-59)		50.85 ± 5.14 (42-59)		p = 0.725 (NS)	
Gender	Males	n = 12	60%	n = 11	55%	--	
	Females	n = 8	40%	n = 9	45%		
Side	Right	n = 12	60%	n = 8	40%	--	
	Left	n = 8	40%	n = 12	60%		

Table 2: Analysis of pain, ROM, functional disability within Mulligan Group (Pre to post test analysis)

Mulligan	Pre intervention (Mean ± SD)	Post intervention (Mean ± SD)	Percentage of change	Z value ^b (Non parametric significance)	t value ^a (Parametric) Significance P value	95% Confidence interval of the difference		Effect Size (r)
	(min-max)	(min-max)				Lower	Upper	
VAS	6.71 ± 1.25 (5-9)	3.37 ± 3.60 (0-18)	-49.77%	-3.180 P = 0.001**	4.413 P < 0.000**	1.756	4.924	+ 0.52 (Large)
SPADI pain in %	57.50 ± 4.48 (50.00 - 64.00)	16.90 ± 4.47 (12.00 - 28.00)	-70.60%	-3.932 P < 0.000**	47.230 P < 0.000**	38.800	42.399	+ 0.97 (Large)
SPADI disability in %	35.11 ± 3.27 (30.00 - 41.25)	11.13 ± 2.77 (7.50 - 17.50)	-68.29%	-3.925 P < 0.000**	35.598 P < 0.000**	22.565	25.384	+ 0.97 (Large)
SPADI Total in %	43.76 ± 3.24 (38.46 - 50.00)	13.30 ± 3.05 (8.46 - 20.76)	-69.60%	3.925 P < 0.000**	48.940 P < 0.000**	29.159	31.765	+ 0.97 (Large)
AROM abduction	58.30 ± 7.51 (48-73)	95.75 ± 8.60 (85-110)	64.23%	3.925 P < 0.000**	-34.845 P < 0.000**	-39.700	-35.200	+ 0.91 (Large)
AROM External rotation	8.60 ± 3.08 (5 - 15)	28.40 ± 3.64 (20 - 35)	23.02%	3.925 P < 0.000**	-27.626 P < 0.000**	-21.300	-18.300	+ 0.94 (Large)
PROM abduction	67.85 ± 7.56 (55 - 80)	103.40 ± 9.23 (90 - 115)	52.39%	-3.928 P < 0.000**	-22.081 P < 0.000**	-38.920	-32.180	+ 0.903 (Large)
PROM External rotation	14.20 ± 3.57 (10 - 20)	34.15 ± 4.25 (25-40)	14.04%	-3.943 P < 0.000**	-24.356 P < 0.000**	-21.664	-18.236	+ 0.93 (Large)

** Statistically Significant difference p < 0.05; NS- Not significant; a. Pared t test. b. Wilcoxon Signed Ranks Test

Table 3: Analysis of pain, ROM, functional disability within Spencer Group (Pre to post test analysis)

Spencer Group	Pre intervention (Mean ± SD) min-max	Post intervention (Mean ± SD) min-max	Percentage of change	Z value ^b (Non parametric significance)	t value ^a (Parametric)	95% Confidence interval of the difference		Effect Size (r)
						Lower	Upper	
VAS	6.30 ± 1.11 (5- 8)	3.58 ± 1.20 (2-6)	-43.17%	-3.925 P < 0.000**	12.579 P < 0.000**	2.259	3.161	+ 0.76 (Large)
SPADI pain in %	58.90 ± 6.37 (50.00 - 68.00)	26.70 ± 5.66 (18.00 -38.00)	-54.66%	-3.929 P < 0.000**	22.315 P < 0.000**	29.179	35.220	+ 0.93 (Large)
SPADI disability in %	39.93 ± 3.02 (35.00 - 43.75)	24.06 ± 5.27 (13.75 - 32.50)	-39.74%	-3.930 P < 0.000**	16.916 P < 0.000**	13.910	17.839	+ 0.87 (Large)
SPADI Total in %	47.10 ± 3.88 (40.76 - 52.30)	25.26 ± 4.82 (15.38 - 32.30)	-46.36%	-3.922 P < 0.000**	22.509 P < 0.000**	19.814	23.876	+ 0.92 (Large)
AROM abduction	64.95 ± 11.42 (48- 85)	85.75 ± 12.20 (70-110)	32.02%	-3.929 P < 0.000**	-17.270 P < 0.000**	-23.321	-18.279	+ 0.66 (Large)
AROM External rotation	9.50 ± 3.22 (5 - 15)	20.45 ± 3.73 (15 -27)	11.52%	-3.946 P < 0.000**	-16.620 P < 0.000**	-12.329	-9.571	+ 0.84 (Large)
PROM abduction	74.15 ± 10.72 (55 - 93)	93.90 ± 11.64 (78 - 115)	26.63%	-1.551 P < 0.000**	-15.721 P < 0.000**	-22.379	-17.121	+ 0.66 (Large)
PROM External rotation	22.75 ± 8.12 (12 - 38)	26.25 ± 4.75 (20 - 35)	15.38%	-3.925 P < 0.000**	-1.601 P < 0.000**	-8.074	1.074	+ 0.25 (Small)

** Statistically Significant difference p < 0.05; NS- Not significant; a. Paired t test. b. Wilcoxon Signed Ranks Test

Table 4: Comparison of means of pain, ROM, functional disability between Mulligan and Spencer Groups (PREINTERVENTION COMPARISON)

Pre-intervention	Mulligan Group (Mean ± SD) min-max	Spencer Group (Mean ± SD) min-max	Percentage of difference	Z value ^b (Non parametric)	t value ^a (Parametric) Significance P value	95% Confidence interval of the difference		Effect Size r
						Lower	Upper	
VAS	6.71 ± 1.25 (5 - 9)	6.30 ± 1.11 (5- 8)	-6.30%	-1.030 p = 0.303	1.104 p=0.277	-.347	1.177	+ 0.171 (Small)
SPADI pain in %	57.50 ± 4.48 (50.00 - 64.00)	58.90 ± 6.37 (50.00 - 68.00)	2.40%	-.847 p=0.397	-.803 p=0.427	-4.929	2.129	+ 0.12 (Small)
SPADI disability in %	35.11 ± 3.27 (30.00 - 41.25)	39.93 ± 3.02 (35.00 - 43.75)	12.84%	-3.843 p<0.000**	-4.844 p<0.000**	-6.841	-2.808	+ 0.608 (Medium)
SPADI Total in %	43.76 ± 3.24 (38.46 - 50.00)	47.10 ± 3.88 (40.76 - 52.30)	7.33%	-2.633 p = 0.008	-2.953 p=0.005**	-5.637	-1.052	+ 0.423 (Medium)
AROM abduction	58.30 ± 7.51 (48 - 73)	64.95 ± 11.42 (48 - 85)	10.79%	-1.887 p = 0.059*	-2.175 p=0.036**	-12.840	-.460	+ 0.352 (Medium)
AROM External rotation	8.60 ± 3.08 (5 - 15)	9.50 ± 3.22 (5 - 15)	9.94%	-.942 p = 0.346	-.903 p=0.372	-2.919	1.119	+ 0.141 (Small)
PROM abduction	67.85 ± 7.56 (55 - 80)	74.15 ± 10.72 (55 - 93)	8.87%	-1.949 p = 0.051	-2.147 p=0.038	-12.241	-.359	+ 0.322 (Medium)
PROM External rotation	14.20 ± 3.57 (10 - 20)	22.75 ± 8.12 (12 - 38)	46.27%	-3.568 p<0.000**	-4.308 p<0.000**	-12.568	-4.532	+ 0.563 (Large)

** Statistically Significant difference p < 0.05; NS- Not significant a. Independent t test b. Mann-Whitney Test

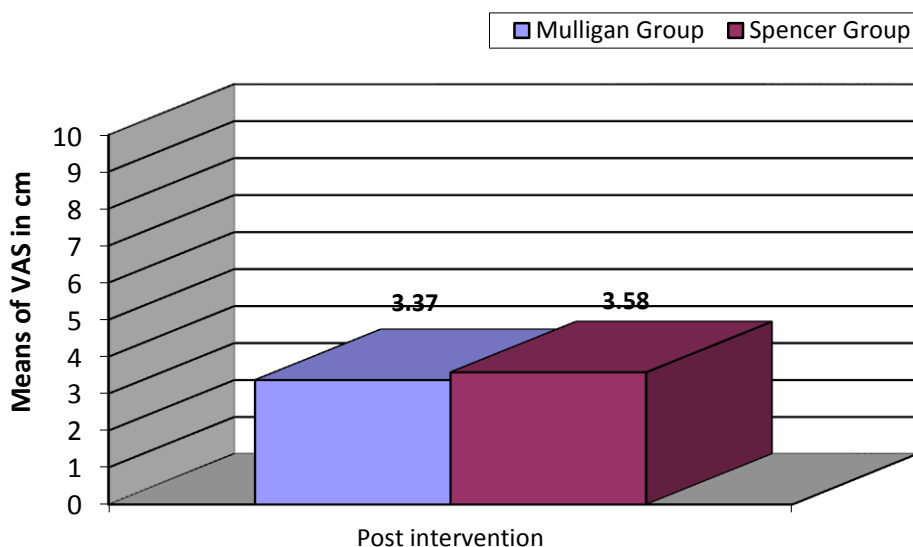
Table 5: Comparison of means of pain, ROM, functional disability between Mulligan and Spencer Groups

(POST INTERVENTION COMPARISION)

Post-intervention	Mulligan Group (Mean ± SD) min-max	Spencer Group (Mean ± SD) min-max	Percentage of difference	Z value ^b (Non parametric) P	t value ^a (Parametric) Significance p value	95% Confidence interval of the difference		Effect Size r
						Lower	Upper	
VAS	3.37 ± 3.60 (0-18)	3.58 ± 1.20 (2-6)	3.47%	-2.023 P = 0.043	-0.253 P = 0.802	-1.936	1.506	+ 0.03 (Small)
SPADI pain in %	16.90 ± 4.47 (12.00 -28.00)	26.70 ± 5.66 (18.00 -38.00)	44.95%	-4.567 P < 0.000**	-6.072 P < 0.000**	-13.067	-6.532	+ 0.69 (Large)
SPADI disability in %	11.13 ± 2.77 (7.50 - 17.50)	24.06 ± 5.27 (13.75 - 32.50)	73.48%	-5.288 P < 0.000**	-9.702 P < 0.000**	-15.621	-10.228	+ 0.838 (Large)
SPADI Total in %	13.30 ± 3.05 (8.46 - 20.76)	25.26 ± 4.82 (15.38 - 32.30)	62.03%	-5.213 P < 0.000**	-9.361 P < 0.000**	-14.548	-9.375	+ 0.826 (Large)
AROM abduction	95.75 ± 8.60 (85-110)	85.75 ± 12.20 (70-110)	-10.44%	-2.540 P = 0.011**	2.995 P = 0.005**	3.241	16.759	+ 0.428 (Medium)
AROM External rotation	28.40 ± 3.64 (20 -35)	20.45 ± 3.73 (15 -27)	-32.54%	-4.671 P < 0.000**	6.811 P < 0.000**	5.587	10.313	+ 0.733 (Large)
PROM abduction	103.40 ± 9.23 (90 -115)	93.90 ± 11.64 (78 - 115)	-9.63%	-2.536 P = 0.011**	2.858 P = 0.007**	2.771	16.229	+ 0.412 (Medium)
PROM External rotation	34.15 ± 4.25 (25-40)	26.25 ± 4.75 (20 - 35)	-26.15%	-4.199 P < 0.000**	5.534 P < 0.000**	5.010	10.790	+ 0.659 (Large)

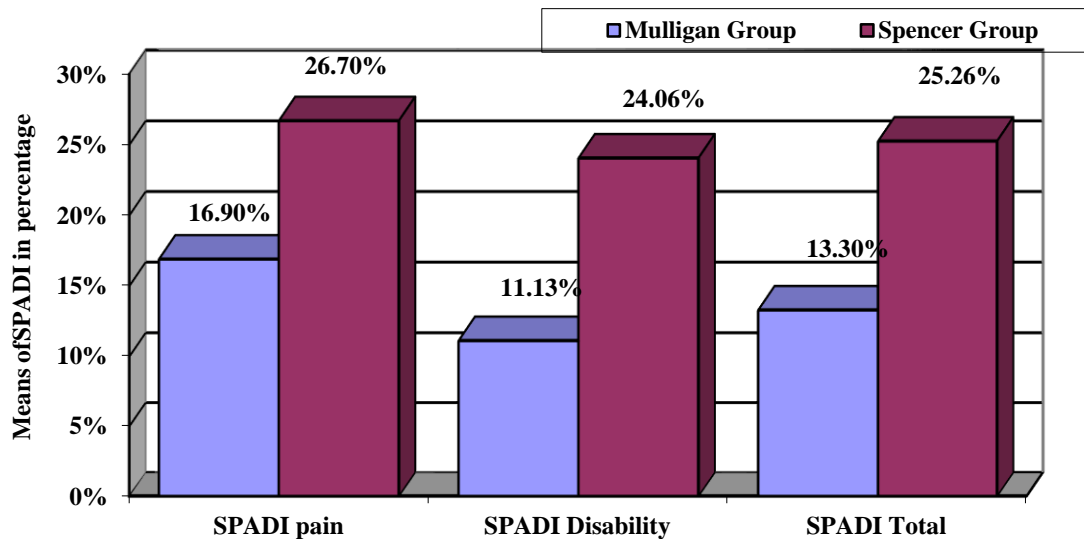
** Statistically Significant difference p < 0.05; NS- Not significant a. Independent t test b. Mann-Whitney Test

Graph- 1: Comparison of pain between Mulligan and Spencer Groups (POSTINTERVENTION COMPARISION)



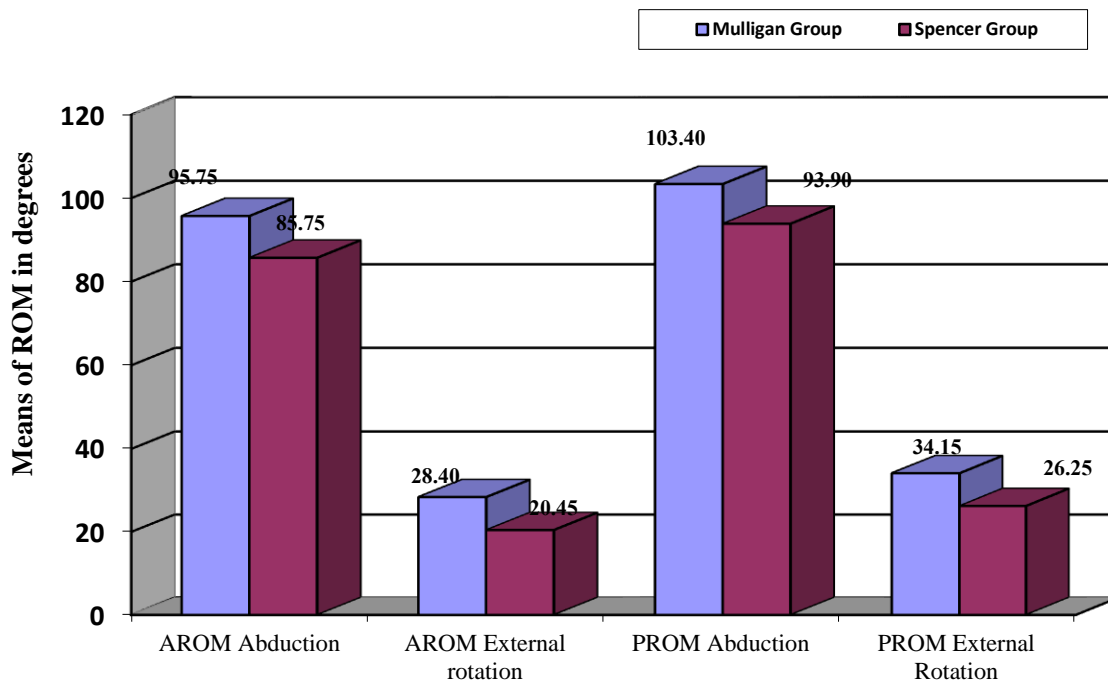
The above graph shows that when post intervention means of VAS was compared there is no statistically significant difference in means between the groups.

Graph- 2: Comparison of SPADI between Mulligan and Spencer Groups (POSTINTERVENTION COMPARISION)



The above graph shows that when post intervention means of SPADI pain, disability, total score were compared there is statistically significant difference in means between the groups.

Graph- 3: Comparison of ROM between Mulligan and Spencer Groups (POSTINTERVENTION COMPARISION)



The above graph shows that when post intervention means AROM and PROM of Shoulder abduction and external rotation were compared there is statistically significant difference in means between the groups.

DISCUSSION

In the present study it was found that there is a statistically significant improvement in pain, shoulder mobility and functional disability within MWM and Spencer group. Between the group analysis found that there is no statistically significant difference between MWM group and Spencer group in improvement of pain, but there is statistically significant difference in improvement of shoulder mobility, functional disability for subjects with frozen shoulder.

In Mulligan's group, the improvement in pain, shoulder mobility and functional disability could be because of Mulligan's mobilization with movement which is a combination of an active movement with simultaneous passive accessory mobilization which helps in rapid restoration of movement. MWM technique found to be effective by neurophysiological mechanism of production of initial hypoalgesia based on stimulation of peripheral mechanoreceptors and the inhibition of nociceptors and altering sympathetic nervous system, and biomechanical concept of positional fault correction. This treatment technique

produces a total and immediate pain relief during the treatment application. It corrects the positional fault and there is an immediate change in the bony position during application of MWM. One explanatory mechanism underlying this manipulative therapy induced pain modulation is the activation of the descending pain inhibitory system within the central nervous system.¹⁵ The active movement in this technique stimulates the proprioceptive tissues, such as the golgi tendon organ by tendon stretch.⁴⁰ MWM repositions the joint, causing it to track normally.¹⁹ MWM passively stretches the tightened soft tissues and shoulder capsule in adhesive capsulitis and thereby restores the normal extensibility of the shoulder capsule and tight soft tissues. This initial effect is sufficient to stimulate the long term changes in nociceptive and motor system dysfunction that are reflected in pain relief and improved function.²⁶ Jing-Ian Yang et al studied to compare the use of three mobilization techniques – end range mobilization, mid range mobilization and MWM in the management of subjects with frozen shoulder syndrome and found that end range mobilization and MWM were more effective in increasing mobility and functional ability.¹³ Furthermore enhanced muscle function and increased ROM after MWM treatment were observed in many studies.¹³⁻¹⁷ Therefore in present study the mechanisms behind the effectiveness of MWM is based on the neurophysiologic effect on pain reduction, correction of mechanical dysfunction and positional fault. Thus, promoting alleviation of pain, restoring ROM and earlier return to function.

In Spencer group the improvement in pain, shoulder mobility and functional disability could be because Spencer technique is aimed to decrease pain by altering the circulatory pain biomarkers. Its passive rhythmic movement re-establishes the arthrokinematic gliding and rolling thereby restoring shoulder mobility. Spencer technique increases pain free ROM by stretching the shoulder capsule and tight soft tissues, thus restoring specific joint motion. This technique when applied increases the lymphatic flow from the treatment area. With this technique the joint regains its normal ROM and resets neural reflexes.⁸ This technique helps the restricted joints to improve their function as well as positively affect other emotional, social and cognitive areas. Passive repetitive translator movement, traction or gliding improves nutrition, circulation and lubrication in the joint structures. It reverses the negative changes in the joint, and normalise arthrokinematic gliding and rolling movement. The increased gliding will normalise the

osteokinematic rotation and enable the restoration of shoulder mobility.²⁷ Furthermore Spencer technique reduces or nullifies the physical signs of somatic dysfunction, tissue changes, asymmetry, restriction of motion and tenderness. The underlying mechanism of this manipulative technique in reduction of pain is that this technique influences the levels of circulatory pain biomarkers. Pain is associated with the production and release of multiple nociceptives, inflammatory mediators, circulatory neurochemical biomarkers. After treatment concentration of several circulatory biomarkers were altered. Changes from baseline levels of these biomarkers occurred immediately after, as well as 24 hours after the treatment.²⁸ These mechanisms of Spencer technique in the present study might have shown reduction in pain levels.

When the improvement in pain in MWM group was compared with Spencer group subjects there, was no significant difference, however MWM group subjects showed greater percentage of improvement in shoulder abduction and external rotation ROM and functional disability. This could be due to added effect of active movement along with simultaneous passive accessory mobilization in MWM technique which is lacking in Spencer technique. MWM technique was better in improving function as it has the additional benefit which may engage additional proprioceptive tissues, such as the golgi tendon organs activated by tendon stretch and restored the normal glenohumeral arthrokinematics and resulted in capsular stretching.⁴²

The difference in improvement can be variable as pre intervention comparison of means between MWM group and Spencer group found that there is no statistically significant difference in VAS, SPADI pain, AROM external rotation, PROM abduction whereas there is statistically significant difference in SPADI disability, SPADI total, AROM abduction and PROM external rotation between the groups. Therefore this may also interfere with the post intervention means.

Both the groups received conventional exercises. These exercises also might have shown the added effect in the both groups. Therefore the study is lacking to find the effect with conventional exercises consisting mobility and strengthening exercise. Moreover the study was carried out for one session per day for five days, therefore long term effects of both the techniques are not evaluated. The study also blinded the subjects to reduce the placebo effect that influence on the outcome measures.

Hence, based on the analysis and findings, the present study found that with one week of MWM and Spencer technique, there is no statistically significant difference in pain levels between the groups and pain was measured as a subjective outcome measure. There is a statistically significant difference in objective measures such as shoulder mobility and functional disability. Therefore considering the significant difference in objective measure means the study rejects the null hypothesis.

Limitations of the Study: Subjects with small range group between 40 to 60 years of age were considered for the study, thus results cannot be generalized to individual age. It is a short duration study in which follow up was not done, therefore long term effects were not known. There is lack of control group.

Recommendation for future research: Further study can be carried to find the effect of MWM and Spencer technique comparing with control group. Further study can be done measuring effect of these techniques on other outcome measures. Further randomized controlled trial is needed to find long term effects of both mobilization techniques.

Conclusion

The present study concluded that both MWM and spencer technique are shown to have short term effect on improving pain, shoulder mobility and functional disability. However MWM was found clinically more effective with greater percentage of improvement on improving shoulder abduction, external rotation ROM and functional disability than Spencer technique in subjects with frozen shoulder. It is recommended that application of both MWM technique and Spencer technique is clinically beneficial on improving pain, shoulder mobility and functional disability in the treatment of AC. However greater percentage of improvement can be found in MWM than Spencer technique.

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Conflicts of interest: None

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