



Effectiveness of Mulligan's Technique and Spencer's Technique in Adjunct to Conventional Therapy in Frozen Shoulder: A Randomised Controlled Trial

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ABSTRACT

Background: Frozen shoulder is a common condition with pain, stiffness and limited motion of the shoulder joint, resulting from the fibrosis and contracture of the glenohumeral joint capsule. Physical therapy treatment may include various manual mobilization techniques to regain extensibility of the shoulder capsule and in relieving pain and increase range of motion.

Purpose: The purpose of the study was to compare and find out the effectiveness of Mulligan's technique and Spencer's technique individually when compared with conventional therapy in patients with frozen shoulder.

Methods: 90 patients were selected randomly with frozen shoulder. The study included 3 groups, control group received Conventional therapy, mulligan's group received mulligan's technique MWM and conventional therapy, and spencer's group received Spencer's technique and conventional therapy. The period of intervention was 3 sessions per week for 6 weeks. The outcome measures included NPRS, goniometry and SPADI. ANOVA was done for inter group analysis, post hoc test was done for between group analysis and paired T- test was done for intra group analysis.

Result: There was no significant difference in outcome measures of all the three groups at day 1. All the three groups showed significant difference (p - value $0.000 < 0.05$) at 3 and 6 week in NPRS, shoulder ROM and SPADI. The mean difference and paired T-test values of mulligan's group was more when compared to control group and spencer's group at the end of 6 weeks

Conclusion: In this study we found significant improvement statistically in all the outcome measures in control group, mulligan's group and spencer's group at 6 weeks of intervention. However the functional improvement in mulligan's group was better than control group and spencer group.

Keywords: Frozen Shoulder, MWM, Mulligans Technique, and Spencer's Technique.

1. INTRODUCTION

Frozen shoulder has been described as a painful condition associated with stiffness and difficulty in sleeping on the affected side. The condition can vary from mild to severe pain and from some to severe restriction in the movement; people with this condition struggle with basic activities of daily living such as difficulty in dressing, performing personal hygiene, overhead movements, and sleep disturbance. It is a condition of unknown etiology; it occurs in 2 – 5% of general adult population, 10 – 15% of the people with diabetes. It mainly affects the individuals of 35 – 65 years of age with female predominance.^{1,4} it is said to be a self-limiting process. However in some patients, the disease can last much longer than 1 year.⁷

Frozen shoulder can be defined as insidious and progressive loss of both active and passive shoulder mobility in the glenohumeral joint presumably due to capsular contracture.¹ recent studies showed inflammation and stiffness of the capsule surrounding the glenohumeral joint, greatly restricting motion and causing chronic pain². Much of the disease also involved structures outside the joint capsule. These structures can include coracohumeral ligament in the rotator interval, musculotendinous unit and the subacrominal bursa.^{2,3} The onset of idiopathic frozen shoulder could be due to immunological, biochemical or hormonal imbalance, secondary risk factors include recent injury to the shoulder leading to lack of use due to pain or a recent shoulder surgery,

certain medical conditions such as diabetes mellitus, stroke, lung diseases, connective tissue diseases, thyroid, ischemic heart disease, inflammatory arthritis.^{5,6}

Physiotherapy methods such as active and active assisted exercises, pendular ex's, wand ex's, wall and ladder ex's, capsular stretching ex's and shoulder joint mobilization are often standard exercises in treating frozen shoulder. Electrotherapy modalities such as application of ultrasound, IFT, short-wave diathermy and LASER are used to relieve pain and promote hyperthermic effect to the tissues.

Brain mulligan's technique known as mobilization with movement for peripheral joints combines sustained manual application of "gliding" force to a joint by the therapist while the restricted upper limb movement is performed actively or passively by the patient to restore the reduced accessory glide and the result should be a pain free movement.⁸

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 1961.⁹ this approach is a well-known osteopathic manipulative technique that focuses on mobilization of the glenohumeral and scapulothoracic joints.¹⁰ It is an articular technique with seven different procedures, in this technique passive, smooth, rhythmic motion of the shoulder joint is done by the therapist to stretch contracted muscles, ligaments and capsule. Most of the force is applied at the end range of motion.¹¹

Very few studies have compared these two techniques, Mulligan's technique helps in repositioning the bone positional faults.⁸ whereas Spencer's technique increases pain free range of motion through stretching the tissues; enhancing lymphatic flow and increase joint circulation.¹¹ , As there are no studies in the literature which compared the effectiveness of these two techniques with the control group in frozen shoulder patients, hence the purpose of the present study was to compare and find out the effectiveness of mulligan's technique and spencer's technique individually when compared with conventional therapy on improvement of pain, functional disability and shoulder ROM in subjects with frozen shoulder.

2. MATERIALS AND METHODS

We recruited 90 subjects from the outpatient Department of Physiotherapy, Nizam's Institute Of Medical Sciences, and Hyderabad. Subjects diagnosed as frozen shoulder by orthopedic department were included in the study. Institutional ethical committee approval was taken.

Criteria for inclusion were age group of 35 – 65 years of both genders, unilateral adhesive capsulitis, subjects who had restricted ROM (loss of 25% or greater relative to non-involved shoulder in one or multidirectional), Non – diabetic subjects.

Subjects were excluded if they had recent history of surgery on particular shoulder, Post traumatic and rotator cuff rupture, Neurological deficits affecting shoulder function, Pain or disorders of cervical spine, elbow, wrist or hand, tendon calcification, rheumatoid arthritis, osteoporosis, malignancies, pregnancy, open wounds or skin infections, a recent steroid injection and previous manipulation under anesthesia of effected shoulder.

The subjects were randomly assigned into 3 groups by lottery method who met the inclusion criteria. Informed consent was taken from patient who met the criteria. Allocations were concealed. The outcome measures were blinded

Pre-treatment evaluation was done on the first day as baseline measurement; the outcome measures numerical pain rating scale NPRS, shoulder pain and disability index SPADI and shoulder range of motion ROM were taken by the third person (physiotherapist) who was trained and the principal investigator was blinded.

Group 1 received conventional therapy, Group 2 received mulligans technique MWM along with conventional therapy, and Group 3 received spencer's technique along with conventional therapy. At the end of session (day 1), the subjects were asked for any increase in pain. If no adverse response was reported, further sessions were carried out three sessions a week for six weeks. All the 3 groups were asked to continue conventional therapy exercises as home based program as the dosage mentioned below and within pain free limit. Follow up evaluation was done and documented at the end of 3rd week, and 6th week, all the final outcome measures were taken and data analysis between day1 to week 6 was done for the final result. There were 5 dropouts due to personal reasons.

Conventional Therapy: Subjects received ultrasound therapy and exercise programme.

The ultrasound treatment was given for 10 - 18 sessions of 3MHz frequency with an intensity of 1.5 W / CM² for a period of 5 – 10 minutes duration.

The exercise therapy programme includes active and active assisted range of motion exercises, isometric exercises, Codman's pendulum exercises, wand, pulley and finger ladder exercises, capsular stretching, pectoral stretch, scapular stabilization exercises, and warm water fermentation for (10 minutes). All were directed to do the same as Home Exercise Program (HEP) at least twice daily.

Dosage: 3 sets for 10 repetitions with 2 minutes rest between sets for 6 weeks.

Mulligan's group: Subjects received MWM and conventional therapy

Mulligan's technique Mobilization with Movement

The mulligan's technique was performed on the involved shoulder as described by mulligan²³. The treatment was administered by the physiotherapist who was trained in mulligan's technique. The therapist applied passive accessory glide as the patient moved the arm actively in the desired direction with in a pain free range.

To Increase Shoulder Flexion

Patient positioned in relaxed supine position, the therapist stood laterally to the affected joint in stride stance and stabilize the scapula and clavicle with one hand and the distal end of humerus with the other. The belt is placed close to the shoulder joint line and is secured around the therapist's waist; the glide was given to distract the humerus laterally, while maintaining the glide patient was asked to perform slow active shoulder movement (flexion) and apply passive overpressure at the end of new available range. The therapist moved along the movement to sustain the glide along the treatment plane.

Internal Rotation and External Rotation

Patient positioned in supine, therapist stood lateral to the affected joint. The patients shoulder and elbow were placed in 90° of flexion, belt was placed close to the shoulder joint line and secured around the therapist's waist, and therapist pulled the belt laterally to distract the joint and stabilized the humerus by holding the distal end of humerus with both hands. Patient was then asked to perform the offending movement (internal and external rotation) actively, and give passive overpressure with the other hand at the end of new available range.

Abduction

Patient in a relaxed sitting position, belt was placed around the head of the humerus and postero-lateral and inferior glide was maintained. 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 to the end of pain free range (abduction). The glide was sustained during the movement and released after returning to the starting position. Patients were asked to continue conventional therapy as HEP

Dosage: 3 sets for 10 repetitions with 1 minute rest between sets. 3 times a week for 6 weeks

Spencer's Group

Technique was performed on the involved shoulder as mentioned in the study conducted by Knebl et al.,¹⁰ DA Patriquin⁹ and Nicholas NS²⁴

Spencer's Technique

Patient positioned in side lying with the shoulder to be treated uppermost, the therapist stood in front of the patient stabilizing the superior aspect of the shoulder girdle, the fixed shoulder girdle provided a resistant structure against which to stretch the soft tissues around the glenohumeral articulation as the arm was used as a long lever. The therapist then supports the wrist and forearm of the patient and does passive, smooth, rhythmic back and forth motion of arm and is carried to the extreme limit permitted by the contracted muscles, ligaments and the capsule of the shoulder.

Step 1 – shoulder extension with elbow flexion: patients elbow was maintained in a flexed position and the arm was extended until the restricted barrier.

Step 2 - shoulder flexion with elbow extension: patients flexed elbow was extended and moved anteriorly into shoulder flexion until the restricted barrier.

Step 3 – circumduction with compression: grasping the elbow of the patient with his shoulder in 90° abduction, moved the elbow in small clockwise and counter clockwise circles direction with compressive force.

Step 4 – circumduction with distraction: therapist maintained the traction of the patients shoulder joint in 90° of abduction and holding either elbow or wrist induced small clockwise and counter clockwise circles

Step 5 – shoulder abduction and internal rotation with elbow flexion: patient was asked to place his hand on therapists forearm for the support and then therapist performed abduction and internal rotation of patients arm

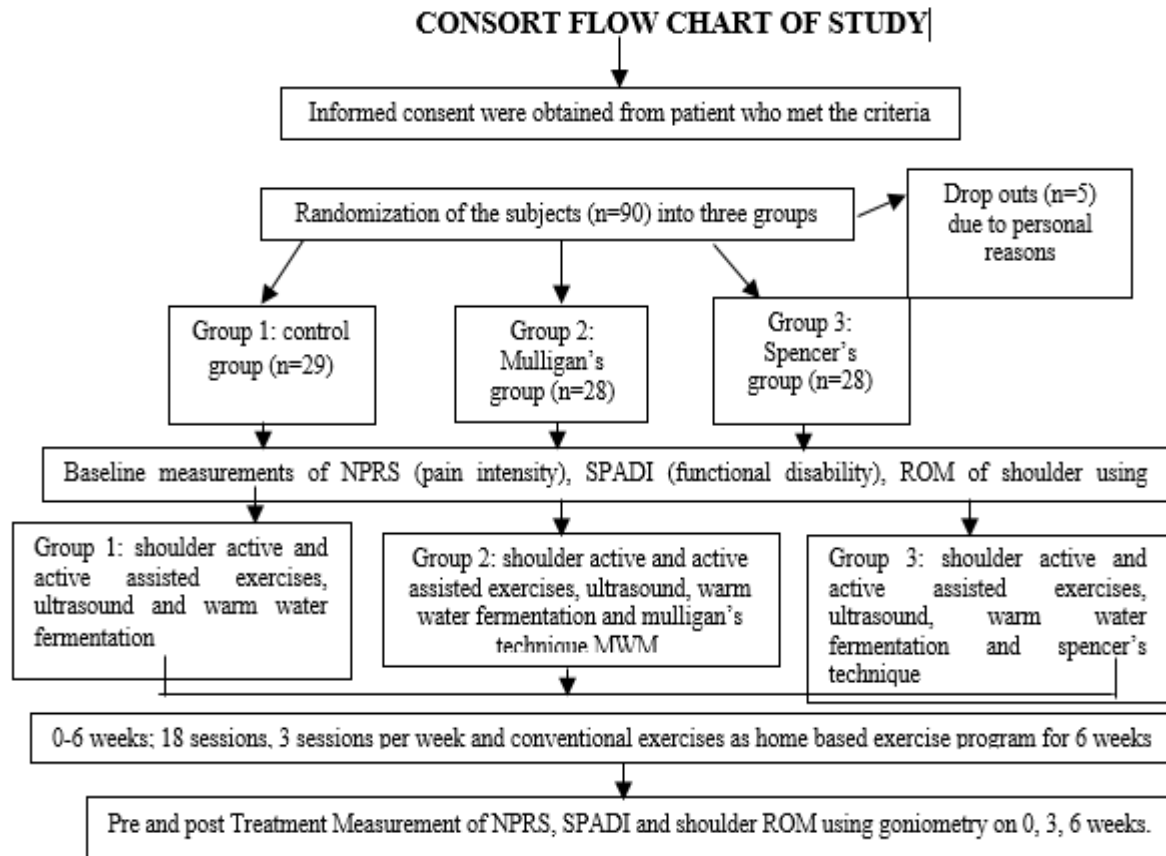
Internal rotation (90°) — therapist placed the dorsum of the patient's hand behind his or her hip and moved the patients elbow anteriorly

Step 6 - shoulder adduction and external rotation with elbow flexion: patient was asked to place his hand on therapists forearm for the support and then the therapist takes patients arm into adduction and external rotation.

Step 7 - stretching tissue and pumping fluids with the arm extended: therapist interlocks his fingertips over the deltoid muscle, patient's hand was placed over the therapist shoulder, and the therapist slowly moved the arm away from the shoulder and released, repeated this 5–10 times if needed.

Dosage: 3 sets for 10 repetitions with 1 minute rest between sets 3 times a week for 6 week

3. PROCEDURE



4. STATISTICAL ANALYSIS AND RESULT

The study included 90 subjects out of which there were 5 drop out due to personal reasons .The findings of the present study indicate that out of 85 subjects in these sample 46 (54.1%) are females and 39 (45.9%) are males respectively. The present study shows the female predominance. 43 subjects left limb was affected and the percentage of (50.6%) and 42 subjects with right limb and percentage of (49.4%) and 37(43.5%) percent of care givers belong to age group of 40 – 50 years, while 33 (38.3%) percent belong to age group of 50-60 years, 9 (10.6%) percent belong to age group of >60 years and remaining 6 (7.1%) percent belong to age group of 30 – 40 years.

NPRS: There was no significant difference among control group, mulligan’s group and spencer’s group on day 1 since ANOVA f-value 2.377 and P- value 0.099 is more than 0.05. A significant difference exists among Control Group, mulligan’s and spencer’s group at Week 3 and 6 since P-value 0.000 is less than 0.05.

Results of multiple comparison showed no significant difference between control group and spencer’s group in 3rd week as the p value 0.385 is greater than 0.05, and there was significant difference between control and mulligan’s group, mulligan’s and spencer’s group. In 6th week there was Significant difference (p<0.05) exists between all the three groups.

TABLE 1: NPRS Paired t-test

GROUP		Paired Differences Mean	T	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	2.310	14.646	28	.000
Mulligan’s	DAY 1-WEEK 6	6.036	38.108	27	.000
Spencer’s	DAY 1-WEEK 6	3.750	17.881	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 14.646, 38.108 and 17.881 respectively, as p value- $0.000 < 0.05$ hence there is significant difference when compared day1 to week 6.

RANGE OF MOTION

There was no significant difference among control group, mulligan’s group and spencer’s group on day 1 flexion, abduction, internal rotation, external rotation and extension. Since p-value is greater than 0.05.

FLEXION: Week 3 flexion ANOVA f-value 1.881 and P- value $0.159 > 0.05$ hence there was no significant difference between groups, A significant difference was seen in week 6 since ANOVA f- value 7.707 and p- value $0.001 < 0.05$.

Results of multiple comparison showed no significant difference between control and mulligan’s group, control and spencer’s group and mulligan’s and spencer’s group in 3rd week as p-value 0.107, 0.090 and $0.930 > 0.05$. In 6th week there was no significant difference between mulligan’s and spencer’s group as p- value $0.162 > 0.05$, and there was significant difference between control and mulligan’s group, control and spencer’s group as ($p < 0.05$).

TABLE 2: ROM FLEXION Paired t-test

GROUP		Paired Differences Mean	T	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	-51.966	-16.742	28	.000
Mulligans	DAY 1-WEEK 6	-63.000	-19.150	27	.000
Spencer’s	DAY 1-WEEK 6	-53.036	-18.722	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 16.742, 19.150 and 18.722 respectively, as p value- $0.000 < 0.05$ hence there is significant difference when compared day1 to week 6.

ABDUCTION: Week 3 abduction ANOVA f- value 23.561 and p- value $0.000 < 0.05$, week 6 ANOVA f- value 11.011 and p- value $0.000 < 0.05$. there was significant difference between groups. Results of multiple comparison showed no significant difference between control and spencer’s group in 3rd week as p-value $0.193 > 0.05$, there was significant difference between control and mulligan’s group, mulligan’s and spencer’s group as $p < 0.05$. In 6th week there was Significant difference ($p < 0.05$) exists between all the three groups.

TABLE 3: ROM ABDUCTION: Paired t-test

GROUP		Paired Differences Mean	T	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	-33.103	-12.675	28	.000
Mulligan’s	DAY 1-WEEK 6	-44.500	-14.230	27	.000
Spencer’s	DAY 1-WEEK 6	-38.036	-12.440	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 12.675, 14.230 and 12.440 respectively, as p value- $0.000 < 0.05$ hence there is significant difference when compared day1 to week 6.

INTERNAL ROTATION: Week 3 internal rotation ANOVA f- value 4.862 and p- value $0.010 < 0.05$, week 6 ANOVA f-value 7.867 and p-value $0.001 < 0.05$. there was significant difference between groups. Results of multiple comparison showed no significant difference between control and spencer, mulligan’s and spencer’s group in 3rd week as p-value 0.164, $0.094 > 0.05$, there was significant difference between control and mulligan’s group as $p < 0.05$. In 6th week there was no significant difference between control and spencer’s group as p-value $0.192 > 0.05$, there was significant difference between control and mulligan’s group, mulligan’s and spencer’s group as $p < 0.05$.

TABLE 4: ROM INTERNAL ROTATION: Paired t-test

GROUP		Paired Differences Mean	T	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	-24.828	-16.565	28	.000
Mulligan’s	DAY 1-WEEK 6	-36.250	-18.103	27	.000
Spencer’s	DAY 1-WEEK 6	-26.071	-15.764	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 16.565, 18.103 and 15.764 respectively, as p value- $0.000 < 0.05$ hence there is significant difference when compared day1 to week 6.

EXTERNAL ROTATION: Week 3 external rotation ANOVA f- value 3.106 and p – value 0.050=0.05, week 6 ANOVA f-value 5.700 and p-value 0.005<0.05. There was significant difference between groups.

Results of multiple comparison showed no significant difference between control and mulligan’s group, control and spencer’s group in 3rd week as p-value 0.070, 0.570 >0.05, there was significant difference between mulligan’s and spencer’s group. In 6th week there was no significant difference between control and spencer’s group as p-value 0.572 >0.05, there was significant difference between control and mulligan’s group, mulligan’s and spencer’s group as p<0.05.

TABLE 5: ROM EXTERNAL ROTATION: Paired t-test

GROUP		Paired Differences Mean	T	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	-33.103	-17.761	28	.000
Mulligan’s	DAY 1-WEEK 6	-38.393	-20.120	27	.000
Spencer’s	DAY 1-WEEK 6	-34.107	-24.192	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 17.761, 20.120 and 24.192 respectively, as p value- 0.000<0.05 hence there is significant difference when compared day1 to week 6.

EXTENSION: Week 3 extension f- value 2.644 and p- value 0.077>0.05, there was no significant difference between groups. Week 6 f-value 3.117 and p- value 0.050=0.05, there was significant difference between groups.

Results of multiple comparison showed no significant difference between control and spencer’s group, mulligan’s and spencer’s group in 3rd week as p-value 0.101, 0.592 >0.05, there was significant difference between control and mulligan’s group as p<0.05. in 6th week there was no significant difference between control and spencer’s group, mulligan’s and spencer’s group as p-value 0.495, 0.088 >0.05, there was significant difference between control and mulligan’s group as p<0.05.

TABLE 6: ROM EXTENSION: Paired t-test

GROUP		Paired Differences Mean	T	df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	-23.621	-9.930	28	.000
Mulligan’s	DAY 1-WEEK 6	-29.500	-14.033	27	.000
Spencer’s	DAY 1-WEEK 6	-24.821	-16.680	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 9.930, 14.033 and 16.680 respectively, as p value- 0.000<0.05 hence there is significant difference when compared day1 to week 6.

SHOULDER PAIN AND DISABILITY INDEX: There was no significant difference among control group, mulligan’s group and spencer’s group on day 1 since ANOVA f-value is 1.983 and P- value 0.144 >0.05. Week 3 ANOVA f-value 19.410 and p-value 0.000<0.05, week 6 ANOVA f-value 53.858 and p-value 0.000<0.05. Hence there was significant difference between groups.

Results of multiple comparison showed no significant difference between mulligan’s and spencer’s group in 3rd week as p-value 0.167>0.05, there was significant difference between control and mulligan’s group, control and spencer’s group as p<0.05. In 6th week there was Significant difference (p<0.05) exists between all the three groups.

TABLE 7: SPADI: Paired t-test

GROUP		Paired Differences Mean	t	Df	Sig. (2-tailed)
Control	DAY 1-WEEK 6	30.966	19.503	28	.000
Mulligan’s	DAY 1-WEEK 6	50.357	26.449	27	.000
Spencer’s	DAY 1-WEEK 6	42.786	33.726	27	.000

From the above table the paired t-test values of day 1 versus week 6 in control group, mulligan’s group and spencer’s group are 19.503, 26.449 and 33.726 respectively, as p value- 0.000<0.05 hence there is significant difference when compared day1 to week 6.

5. DISCUSSION

This study was conducted to investigate the Effectiveness of mulligan’s technique and spencer’s technique in adjunct to conventional therapy in frozen shoulder

PAIN: Decrease in pain score are probably because of mechanical and thermal effects in the tissues cause by the ultrasound, warm water fermentation, and joint mobilization.

Mulligan's technique is based on correction of positional faults and restoration of joint arthokinematics, which in turn permits pain free range of motion. It is also found to be effective by neurophysiological mechanism and production of initial hypoalgesia based on stimulation of peripheral mechanoreceptors and the inhibition of nociceptors and altering sympathetic nervous system.

Spencer's technique is aimed to decrease pain by altering the circulatory pain biomarkers; it increases pain free range of motion by stretching the shoulder capsule and tight soft tissues, thus restoring specific joint motion.

RANGE OF MOTION

Shoulder ROM was measured with a standard Goniometer. The findings of the present investigation indicate that shoulder flexion, abduction, internal rotation, external rotation and extension have improved significantly in all the three groups evident by mean values

Mulligan's mobilization with movement is a combination of active movement with simultaneous passive accessory mobilization. The active movement in this technique stimulates the proprioceptive tissues, such as the Golgi tendon organ by tendon stretch. MWM repositions the joint, causing it to track normally. MWM passively stretches the tightened soft tissues and shoulder capsule in frozen shoulder there by restores the normal extensibility of the shoulder capsule and tight soft tissues.

Spencer's technique increases the 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. The passive repetitive translator movements, traction or gliding improves nutrition, circulation and lubrication in the joint structures. It reverses the negative changes in the joint, and normalizes arthokinematic gliding and rolling movement. The increased gliding will normalize the osteokinematic rotation and enable the restoration of shoulder mobility.

Spadi Pain and Disability Index

There is significant improvement in SPADI total score similarly improvement was noted when the total of shoulder pain and total of disability index scores were taken into consideration to assess all three groups for a period of six weeks

The study suggests that control group receiving conventional therapy, mulligan's group receiving MWM along with conventional therapy and spencer's group receiving spencer's technique along with conventional therapy are equally effective in reducing pain and functional disability in patients suffering from frozen shoulder.

However there is significant difference in mean scores of control group, mulligan's group and spencer's group when compared after six weeks of treatment, mulligan's group subjects showed greater percentage of improvement, it could be due to the added effect of gliding force to the joint. Hence this group is much better than control group and spencer's group and control group is least effective working group

The results of this study are also in agreement with a study done by Shahbaz Nawaz Ansari et al., who stated that ultrasound therapy with end range mobilization produced better results than cryotherapy with stretching in reducing pain in frozen shoulder.

The results of this study are also in agreement with a study conducted by Vinod Babu, P. Khyathi et al., who stated that MWM technique and Spencer's technique are clinically beneficial on improving pain, shoulder mobility and functional disability in the treatment of frozen shoulder.

6. CONCLUSION

All the three groups statistically showed improvement in pain, functional disability and shoulder ROM. However the functional improvement in mulligan's group was better than spencer's and control group.

From the result obtained in the study we conclude that application of mulligan's MWM along with exercises and ultrasound therapy produces significant improvement in pain scores, shoulder range of motion and functional ability in frozen shoulder patients.

7. LIMITATIONS

1. Limited sample size
2. Results are applicable to subjects belonging to age group of 30 – 65 years only
3. Short duration study(6 weeks)
4. Samples can be grouped according to severity of the condition and analyzed in future studies

8. SCOPE FOR FURTHER STUDY

1. Better results can be drawn if the study was conducted with large sample size for long duration.
2. Long term follow up of patients is recommended in further studies to long term effects of mulligan's and spencer's technique.
3. Sub grouping of age can be done and studied separately to draw significant results.

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