

Original Article

COMPARITIVE EFFECT OF GONG'S MOBLISATION VERSUS MULLIGAN'S MOBILISATION ON PAIN AND SHOULDER ABDUCTION MOBILITY IN FROZEN SHOULDER

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ABSTRACT

Background and introduction: The purpose is to compare the effect of gong's mobilization versus mulligan's mobilization on improving pain and shoulder abduction mobility for subjects with frozen shoulder.

Method: 30 subjects with unilateral frozen shoulder whose abduction ROM was limited to 120 degree or less were selected and randomized 15 subjects each into Gong's and MWM group. Gong's group received Gong's mobilization with conventional therapy while MWM group received movement with mobilization and conventional therapy for duration of five sessions per week for 3 weeks. A goniometer to measure shoulder abduction ROM and VAS to measure pain were used.

Results: Analysis using Independent 't' test and Mann Whitney U test found that there is no statistically significant difference ($p < 0.05$) between Gong's mobilization and MWM on improving shoulder abduction ROM and pain, however the percentage of change in improvement was greater in MWM group.

Conclusion: The present study concludes that both MWM with conventional therapy and Gong's mobilization with conventional therapy are effective on improving pain and shoulder abduction mobility for subjects with Frozen shoulder.

KEYWORDS: Gong's mobilization; MWM; Frozen shoulder; Shoulder mobility; Pain; ROM; Conventional therapy.

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Access this Article online

Quick Response code



International Journal of Physiotherapy and Research

ISSN 2321- 1822

www.ijmhr.org/ijpr.html

Received: 30-10-2013

Accepted: 05-11-2013

Peer Review: 30-11-2013

Published: 11-12-2013

INTRODUCTION

Frozen shoulder or adhesive capsulitis is characterized by an insidious and progressive loss of active and passive mobility in the glenohumeral joint presumably due to capsular contracture.¹

Clinical symptoms include pain, a limited range of motion (ROM), altered scapulohumeral rhythm and muscle weakness from disuse.^{2,3,4} The prevalence of frozen shoulder is slightly greater than 2% in the general population, affecting persons older than 40 years. Approximately 70% of patients presenting with adhesive capsulitis are women, and 20% to 30%

of those affected develop adhesive capsulitis in the opposite shoulder.⁵

A variety of interventions are used by physiotherapist to reduce pain which includes exercises and electrotherapy techniques with mobilization techniques to decrease pain and to improve mobility.^{6,7} But there is no un animous decision in the selection of these treatment patterns and it is been found that mobilization are integral part of frozen shoulder.^{8,9}

Mulligan incorporated Kaltenborn's principles of passive mobilization. They are thought to achieve painless movement by restoring the reduced accessory glide. Similar principles can

be applied to the treatment of peripheral musculoskeletal disorders and are termed Mobilisation With Movement.^{10,11}

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 aiming to restore a restricted, painful movement to a pain-free and full range state.^{11,12} MWMs provide a passive pain-free end-range corrective joint glide with an active movement. It superimposes accessory movement on the patient's active physiological movement with the aim of overriding the obstruction and re-establishing correct alignment. The accessory movement takes the joint through what would be the normal physiological movement of the joint and it has been found to correct the shoulder malalignment thus inhibiting pain and this leads to increased ROM.^{13,14}

Gong's mobilization is a technique in which a corrective AP or longitudinal caudal glide on the head of the humerus can be sustained while the patient actively abducts the arm. The therapist's opposite hand fixates the scapula so that the glide of the humerus is relative to the scapula. It is important to ensure that the AP glide is applied at right angles to the plane of the glenohumeral joint. The resulting movement must be pain-free. The patient can also be encouraged to activate specific muscles.¹⁵

Joint mobilization techniques are assumed to induce various beneficial effects including neurophysiological, biomechanical and mechanical effects. Mobilization has a positive effect on treatment of frozen shoulder.¹⁶ Pathological changes of the joint capsule cause high intra-articular pressure, which is associated with pain intensity, restriction of the joint capsule reduces joint motion and shoulder function. The aim of manual therapy is to reduce intra-articular pressure by increasing mobility of the joint capsule and its surrounding soft tissue. This results in a reduction of pain and increased range of motion (ROM) and shoulder function. Therefore, beneficial effects of manual therapy can be expected in patients with relatively high pain intensity, strongly reduced ROM and severe limitation of shoulder function.¹⁷

In the treatment of Frozen shoulder, Maitland mobilization aims to improve the ROM by breaking adhesion and stretching of capsule^{18,19} while MWM technique attempts to improve ROM and also corrects the scapulohumeral rhythm by restoration of correct physiological tracking¹⁶ and Gong's mobilization aims to decrease pain and improve ROM.¹⁵

Wontae Gong, et al. concluded that Gong's Mobilization applied to the shoulder joint for shoulder medial rotation was more effective than Antero-posterior glides in increasing ROM since it is an end range mobilization technique which even maintains shoulder joints in normal position.²⁰ Wontae Gong, et al. also found effect of Gong's Mobilization increasing shoulder abduction ROM and this technique is better than AP glides and that Gong's Mobilization is a useful treatment in clinical setting because of its immediate effects.¹⁵

Jing-lan Yang, et al. found that the end-range mobilization/scapular mobilization treatment approach (EMSMTA) is more effective on improvement ROM, disability score, shoulder complex kinematics than a standardized physical therapy program in a subgroup of subjects with frozen shoulder syndrome (FSS).²¹ Guler-Uysal, et al. found that mobilization increased ROM after two weeks when compared to early response to Cyriax approach of deep friction massage in rehabilitation of frozen shoulder.²² Shrivastava Ankit, et al. found that the treatment techniques Maitland and Mulligan's improved the pain VAS score, shoulder range of motion and Shoulder Pain and Disability Index (SPADI) score but response to Mulligan's was better in subjects with frozen shoulder.²³ Jing-lan Yang, et al. compared the use of End range Mobilization, Mid range Mobilization and MWM and found that movement strategies in terms of scapulohumeral rhythm improved after 3 weeks of MWM in subjects with Frozen Shoulder Syndrome (FSS).¹⁴ Aimie F. Kachingwe, et al. when compared the effectiveness of four physical therapy interventions supervised exercise only, supervised exercise with glenohumeral mobilizations, supervised exercise with a mobilization-with-movement (MWM) technique, and a control group receiving only physician advice in the treatment of primary

shoulder impingement syndrome found that MWM group had the highest percentage of change in AROM.²⁴

Pamela Teys, Leanne Bisset et al. found that there is an initial effects of MWM technique on shoulder ROM in the plane of scapula and Pain Pressure Threshold (PPT) in subjects with anterior shoulder pain and in subjects with painful limitation of shoulder movement.¹³ Bang M, Deyle G et al. found that supervised exercise combined with manual therapy was better than supervised exercise alone in the treatment of shoulder impingement.²⁵ Hsu et al. studied on joint position during mobilization on 11 cadavers, found that the application of an anterior-posterior glide towards the end of range of abduction was effective in improving the range of glenohumeral abduction.²⁶

Despite of many studies, there are no studies found in the literature on effect of Gong's Mobilization compared with MWM for subjects with Frozen shoulder. There is a need to know wheather there is a difference in effect of Gong's Mobilization versus MWM on improving pain and shoulder abduction mobility for subjects with Frozen shoulder.

Hence, the purpose of the study is to find the comparative effect of gong's mobilization versus mulligan's mobilization on pain and shoulder abduction mobility for subjects with frozen shoulder. The objectives of this study were to evaluate the effect of Gong's Mobilization by measuring pre and post intervention pain and shoulder abduction ROM in subjects with Frozen shoulder, to evaluate the effect of Mulligan's Mobilization by measuring pre and post intervention pain and shoulder abduction ROM in subjects with Frozen shoulder, to find the comparative effect of Gong's Mobilization versus Mulligan's Mobilization by comparing pain and shoulder ROM measurement pre and post intervention. It was hypothesized that there will be a significant difference between Gong's Mobilization versus Mulligan's Mobilization on improving pain and shoulder abduction mobility for subjects with Frozen shoulder.

MATERIALS AND METHODS

An Experimental study design with two group- Gong's group and MWM group. Subject were included with age of 40 to 50 years⁶ both male

and female subjects. Unilateral Primary Frozen shoulder.²⁷ Subjects having a painful stiff shoulder for at least 3 months.²¹ Subjects having limited Active ROM of a shoulder abduction limited beyond 120 degree or less.¹⁵ Subjects were excluded with Diabetes mellitus,²¹ history of surgery on the particular shoulder,¹⁴ Rheumatoid arthritis,²¹ painful stiff shoulder after a severe trauma,¹⁶ history of fracture around shoulder complex,¹⁶ rotator cuff rupture,²¹ Tendon calcification.²⁸

As this study involve human subjects the Ethical Clearance has been obtained from the Human Ethical Committee of KTG College of Physiotherapy, Bangalore as per the ethical guidelines for Bio-medical research on human subjects. The subjects were recruited from various hospitals and physiotherapy clinics, Bangalore and the study was conducted at KTG Hospital.

Procedure:

Randomized into Groups:

Individually informed consent was taken from all the 30 subjects selected for the study on the basis of inclusion and exclusion criteria. The Gong's group consists of 15 subjects. The MWM group consists of 15 subjects. Randomization was done by using thirty pieces of paper with 15 pieces having the words Gong's Mobilization written on them, 15 pieces having the words MWM Mobilization. All pieces of paper were tightly folded and placed in a box. After shaking the box thoroughly, piece of paper was withdrawn, each piece of paper individually having the group name on it would be added to a list that corresponded with patient numbers from 1-30.

Gong's mobilization:

The subjects sat on knee-high chairs with no back support with the spine in a neutral position and comfortably extended both their arms. Therapist stood on the side opposite to the affected side. The therapist pushed the scapula of the affected side in a posterior to anterior direction with one hand, and pushed the humeral head in an anterior to posterior direction parallel to joint plane with the other hand. This restored the humeral head which have been pushed forward, to its normal position.

Simultaneously, the subject was asked to quickly and powerfully perform shoulder abduction with no external rotation, with elbow flexion in coronal plane, and with palm facing inside and the back of the hand facing outside. During this time, the hands of the therapist kept facing the humeral head with long axis of the palm along with the long axis of the humerus. The therapist follows the subjects performing shoulder abduction, at the same speed while maintaining a little distraction, and adding acceleration in the end range. The procedure was performed Three sets of 10 repetitions, with 1 minute rest between sets. The same procedure will be performed 5 session in a week for 3 weeks.¹⁵



Fig 1: Gong's mobilization



Fig 2: Movement with mobilization



Fig3: Isometric Scapular Retraction.



Fig4: Horizontal abduction exercise with thera band

MWM mobilization:

The MWM technique was performed on the involved shoulder as described by Mulligan. With the subject in a relaxed sitting position, a Mulligan belt was placed around the head of the humerus to glide the humerus head appropriately, as the therapist's hand was used over the appropriate aspect of the head of the humerus. A counter pressure also was applied to the scapula with the therapist's other hand.

The glide was sustained during slow active shoulder movements to the end of the pain-free range and released after return to the starting position. The procedure was performed Three sets of 10 repetitions, with 1 minute rest between sets. The same procedure was performed 5 session in a week for 3 weeks.¹⁴

Conventional Therapy for both the groups:

It includes-

Pendular exercise- Subject was asked lean forward with unaffected forearm supported on a table or bench. Keeping back straight and shoulder relaxed, gently swing your arm forwards and backwards until you feel a mild to moderate stretch, gently swing your arm in circles clockwise until you feel a mild to moderate stretch. Repeat the exercise swinging your arm counter clockwise. Repeat 10 times provided the exercise is pain free.¹⁴

Isometric Scapular Retraction- Tie the middle of a thera band to a doorknob and hold the ends. Subject was asked move back away from the door until the band is taut, then extend arms in front of the chest with palms facing downward. Flexing the elbows and pull them behind the back as far as possible, squeezing the shoulder blades together. Hold this position for five seconds or more.³⁰

Strengthening Rotator cuff- Prone horizontal abduction in which subject was prone with arm hanging over side of table and the thumb facing forward. Slowly raise arm straight out to the side and stop when arm is parallel to the body. This exercise was performed 3 sets with 15 repetition.³⁰

Horizontal abduction exercise with thera band in which subject will face towards the attachment site of the thera band, with the arm extended straight out in front. Slowly pull arm backwards and out to the side, keeping the arm at shoulder height. Row with thera band in which subject was asked to extend the arm straight holding thera band and perform rowing motion backwards, keeping elbows elevated at least 60° away from body.³⁰

Scapular stabilization exercise- In which subject was asked to perform wall and floor push-ups without bending the elbow. Scapular stabilization with exercise ball in upright standing

position where subject will place the exercise ball against wall and will press the exercise ball keeping the arm straight.²⁹



Fig 5: Prone horizontal abduction



Fig 6: Scapular stabilization exercise with exercise ball



Fig 7: Row with theraband

Fig 8: Wall push ups

Total duration of treatment was 3 weeks, 5 sessions per week.

Outcome measures

The subject's VAS for pain, active and passive ROM of shoulder abduction mobility were measured in both the groups before intervention and after three weeks of intervention. Pain was measured using Visual Analogue Scale (VAS) in cm during active shoulder abduction. Shoulder abduction mobility was measured using Goniometer for active and passive shoulder abduction ROM in degrees.

Statistical Methods:

Descriptive statistical analysis has been carried out in this study. Outcome measurements are measured for pain using Visual analog scale in centimeters and Active and passive shoulder abduction ROM and presented as mean \pm SD. Significance is assessed at 5 % level of significance with p value 0.05 less than this is considered as statistically significant difference.

Pearson Chi-Square test and has been used to analyze the significant of basic characteristic of gender, age and side distribution of the subjects studied. 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 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 AND TABLES

The study was carried on total 30 subjects in Gong's Group there were 15 subjects with mean age 43.93 years and there were 7 males 8 females were included in the study. In MWM Group there were 15 subjects with mean age 44.93 years and were 8 males 7 females were included in the study. There is no significant difference in mean ages between the groups. In both the groups there were 8 right sided and 7 left sided subjects with no significant difference between the side distribution between the groups.

Comparison of means of pain and Shoulder abduction ROM between Gong's Group and Mobilization Groups shows that there is no statistically significant difference in means of Visual analogue score for pain and shoulder abduction AROM and PROM when pre intervention means and post intervention means were compared between the groups. There is a no clinical significant difference in post means

with small effect size.

Analysis of pain and functional disability within Gong's and MWM Group shows that in both the groups there is a statistically significant change in means of Visual analog score and Shoulder abduction AROM and PROM in degrees 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. There is clinical significant improvement with large effect size in both the groups.

Basic Characteristics of the subjects d studied		Gong's Group	MWM Group	Between the groups Significance ^a
Number of subjects studied (n)		15	15	--
Age in years (Mean± SD)		43.93± 3.47 (40-50)	44.93± 3.03 (40-50)	p= 0.414 (NS)
Gender	Males	7	8	P=0.751 (NS)
	Females	8	7	
Side	Right	8	8	P=1.000 (NS)
	Left	7	7	

a-Pearson Chi-Square

Table 1: Basic Characteristics of the subjects studied

	Gong's Group (Mean±SD) min-max	MWM Group (Mean±SD) min-max	Percentage of difference	Z value ^b	t value ^a	Significance (2-tailed) P value	95% Confidence interval of the difference		Effect Size r
				(Non parametric)	(Parametric)	Lower	Upper		
PREINTERVENTION									
Visual analog scale score in cm	7.23± 1.46 (5.2- 9.3)	7.64 ± 1.49 (5.1 - 9.5)	5.51%	Z= -.872 P=0.383	0.458	P=0.458 (NS)	-1.51	0.7	0.13 (Small)
Shoulder abduction AROM in degrees	96.20 ± 21.42 (61 - 132)	88.33± 16.69 (65- 122)	-8.52%	Z= -1.038 P=0.299	0.272	P=0.272 (NS)	-6.5	22.2	0.2 (Small)
Shoulder abduction PROM in degrees	107.47 ± 20.53 (69 - 140)	96.60± 16.92 (73- 131)	-10.65%	Z=-1.495 P=0.135	0.125	P=0.125 (NS)	-3.2	24.9	0.27 (Small)
POST INTERVENTION									
Visual analog scale score in cm	5.26±1.41 (3.2-7.4)	5.61 ± 1.18 (3.1 - 7.3)	6.43%	Z= -.643 P=0.520	-0.742	P=0.465 (NS)	-1.32	0.62	0.13 (small)
Shoulder abduction AROM in degrees	122.87 ± 8.22 (84 -155)	123.47± 15.74 (103-152)	0.97%	Z=-.062 P=0.950	-0.087	P=0.931 (NS)	-14.7	13.5	0.02 (Small)
Shoulder abduction PROM in degrees	133.27 ± 22.00 (93 - 165)	132.87± 14.96 (112-159)	-0.30%	Z=-.083 P=0.934	0.058	P=0.954 (NS)	-13.7	14.5	0.01 (Small)

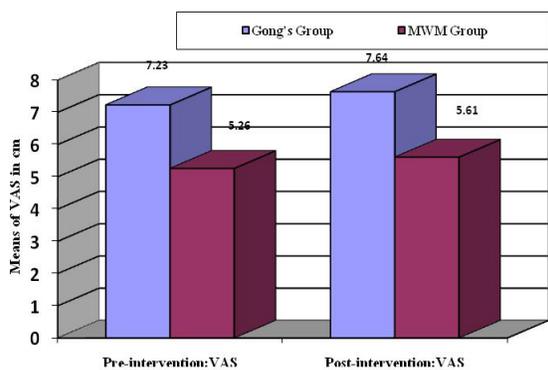
** Statistically Significant difference $p < 0.05$; NS- Not significant a. Independent t test b. Mann-Whitney Test

Table 2: Comparison of means of pain and Shoulder abduction ROM between Gong's Group and Mobilization Groups (PRE and POST INTERVENTION COMPARISON)

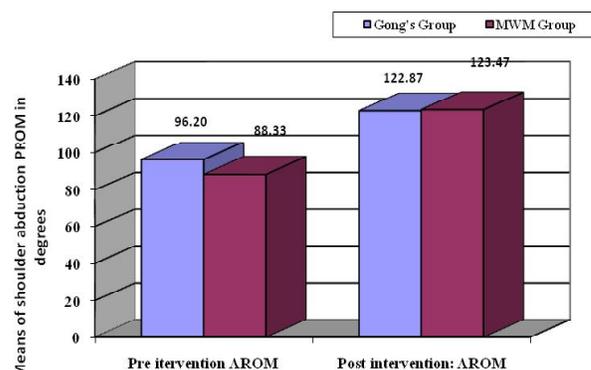
	Pre intervention (Mean±SD) min-max	Post intervention (Mean±SD) min-max	Percentage change	Z value b (Non parametric significance)	t value a (Parametric)	Parametric Significance (2-tailed) P value	95% Confidence interval of the difference		Effect Size (r)
							Lower	Upper	
Gong's Group									
Visual analog scale score in cm	7.23± 1.46 (5.2- 9.3)	5.26±1.41 (3.2-7.4)	-27.24%	-3.422 P <0.001**	11.09	P <0.000**	1.59	2.35	0.56 (Large)
Shoulder abduction AROM in degrees	96.20 ± 21.42 (61 - 132)	122.87 ± 8.22 (84 -155)	27.72%	-3.415** P <0.001**	-32.055	P <0.000**	-28.45	-24.88	0.63 (Large)
Shoulder abduction PROM in degrees	107.47 ± 20.53 (69 - 140)	133.27 ± 22.00 (93 - 165)	24.00%	-3.415** P <0.001**	-18.278	P <0.000**	-28.82	-22.77	0.51 (Large)
MWM Group									
Visual analog scale score in cm	7.64 ± 1.49 (5.1 - 9.5)	5.61 ± 1.18 (3.1 - 7.3)	-26.57%	-3.922 P <0.000**	12.27	P <0.000**	1.67	2.38	0.6 (Large)
Shoulder abduction AROM in degrees	88.33± 16.69 (65- 122)	123.47± 15.74 (103-152)	39.78%	-3.420P <0.000**	-61.863	P <0.000**	-36.35	-33.91	0.73 (Large)
Shoulder abduction PROM in degrees	96.60± 16.92 (73- 131)	132.87± 14.96 (112-159)	37.54%	-3.413 P <0.000**	-33.445	P <0.000**	-38.59	-33.94	0.75 (Large)

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

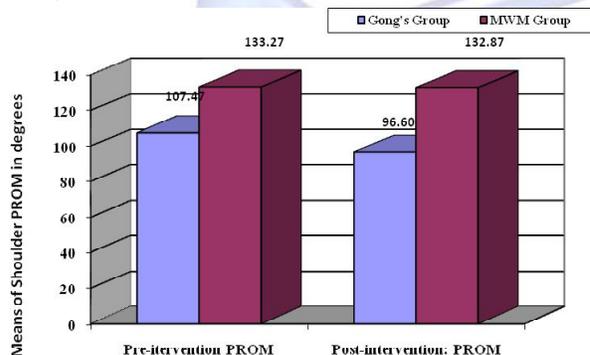
Table 3: Analysis of pain and functional disability within Gong's and MWM Group (Pre to post test analysis)



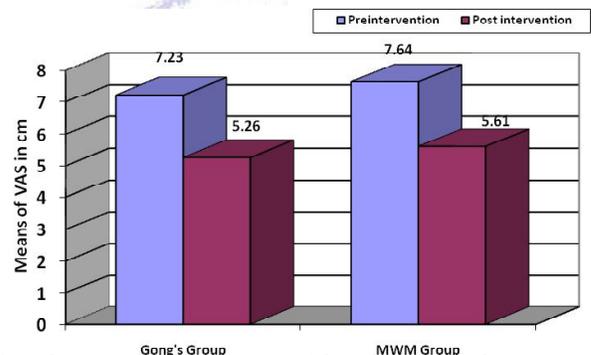
Graph 1a: Comparison of means of VAS between Gong's Group and MWM Group (PRE AND POST INTERVENTION)
The above graph shows that there is no statistically significant difference in means of Visual analogue scores for pain when pre-intervention and post-intervention means were compared between Gong's Group and MWM Group.



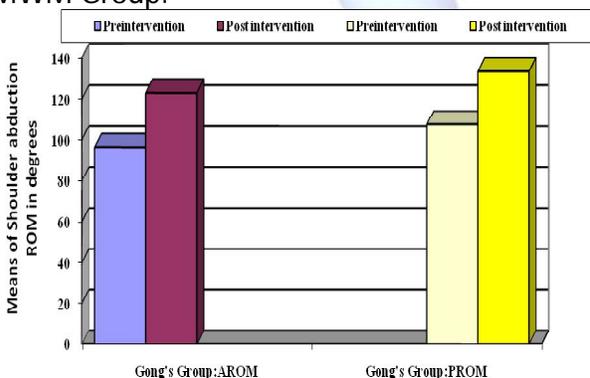
Graph 1b: Comparison of means of SHOULDER ABDUCTION AROM Gong's Group and MWM Group (PRE AND POST INTERVENTION)
The above graph shows that there is no statistically significant difference in means of shoulder AROM when pre-intervention means were compared between Gong's Group and MWM Group.



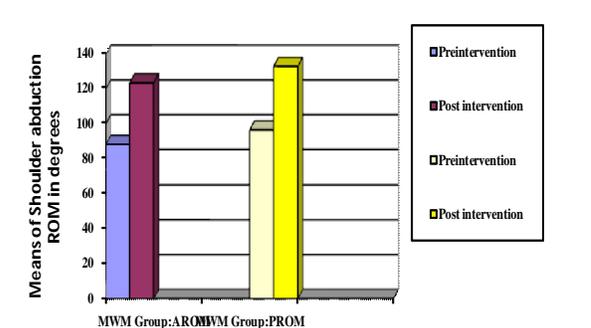
Graph 1c: Comparison of means of SHOULDER ABDUCTION PROM Gong's Group and MWM Group (PRE AND POST INTERVENTION)
The above graph shows that there is no statistically significant difference in means of shoulder PROM when pre-intervention means were compared between Gong's Group and MWM Group.



Graph 2a: Analysis of pain within Gong's and MWM Group (Pre to post test analysis)
The above graph shows that there is a statistically significant reduction in means of VA Score when analyzed from pre intervention to post intervention within Gong's Group and MWM Group.



Graph 2b: Analysis of Shoulder abduction AROM and PROM within Gong's (Pre to post test analysis)
The above graph shows that there is a statistically significant increase in means of active and passive ROM shoulder abduction in degrees when analyzed from pre intervention to post intervention within Gong's Group.



Graph 2c: Analysis of AROM and PROM within MWM Group (Pre to post test analysis)
The above graph shows that there is a statistically significant increase in means of active and passive ROM shoulder abduction in degrees when analyzed from pre intervention to post intervention within MWM Group.

DISCUSSION

In this study finding from the analysis found that there is no statistically and clinically significant difference between MWM mobilization and Gong's mobilization on improvement of pain and shoulder mobility after 3 weeks of programme for subjects with Frozen shoulder. Joint mobilization is a manual therapy that applies passive traction and gliding motion to the articular surface to maintain the free mobility of joints or to restore the normal condition of joints. Joint mobilization can be effectively used to reduce pain and also to improve joint mobility.^{1,14} The manual therapy like mobilization has been shown significantly greater improvements in outcome in patients.³¹ It produces a treatment-specific initial hypoalgesic and sympathoexcitatory effect beyond that of placebo or control.³² Furthermore, mobilization techniques are supposed to increase or maintain joint mobility by inducing rheologic changes in synovial fluid, enhanced exchange between synovial fluid and cartilage matrix, and increased synovial fluid turnover.

In Gong's group, the analysis of pain and shoulder mobility within the group shows that there is a statistically significant change in means of VAS and ROM when analyzed from pre-intervention to post intervention. In this study the increase in shoulder abduction range of motion occurred because with Gong's Mobilization, the abduction of the shoulder joint occurs when the humeral head was in normal position and the normal muscular contraction occurs with the rolling and sliding occurring at the articular surface when the tension of posterior joint capsule is reduced. The main advantage of Gong's Mobilization is that it can be done in sitting position, and it provides immediate effect and it does not require external rotation to improve abduction which can be helpful in frozen shoulder patient where marked limitation of external rotation is present. Hence Gong's Mobilization can be considered as a useful manual therapy tool in the management of frozen shoulder. Joint mobilization is a passive movement applied to the joint surfaces, so shoulder mechanics under passive conditions need to be considered. The joint glides that accompany glenohumeral motions support the

clinical practice of restoring translational movement to restore full physiological motion in the shoulder joint, even though care must be taken in attributing joint translations to external mobilizing glides. Wontae Gong. et. al carried out a study on the effects of Gong's Mobilization applied to the shoulder joint on shoulder medial rotation on 40 subjects and gave Antero-posterior glides in 20 and Gong's Mobilization in 20 subjects. They concluded that Gong's Mobilization was more effective in increasing ROM since it is an end range mobilization technique which even maintains shoulder joints in normal position.²⁰ Vermeulen et al studied to compare the effectiveness of high-grade mobilization techniques (HGMT) with that of low-grade mobilization techniques (LGMT) in subjects with adhesive capsulitis of the shoulder and HGMTs appear to be more effective in improving glenohumeral joint mobility and reducing disability than LGMTs.³³ Nicholson studied on the effect of passive joint mobilization on pain and hypomobility associated with adhesive capsulitis of the shoulder. He mobilized in a gentle way in the anatomical neutral position, progressing in later sessions toward the end of the ROM and concluded that only the passive glenohumeral abduction in the experimental group increased after 4 weeks, and pain scores did not differ between groups.³⁴

In MWM group, analysis of pain and shoulder mobility within the group who received MWM with conventional therapy shows that there is a statistically significant change in means of VAS and ROM when analyzed from pre intervention to post intervention within the group.

MWM improve the normal extensibility of the shoulder capsule and stretch the tightened soft tissues to induce beneficial effects. It also indicates that the adhesive capsule and associated contracted periarticular structures can only be stretched by MWM. Normalization of scapulohumeral rhythm, however, was achieved with MWM techniques in subjects, however in our study the changes in scapulohumeral rhythm was not measures. Furthermore, improved mobility & functional ability also were observed after MWM treatment in various studies. These findings suggest that MWM could increase mobility and improve motor strategies with regard

to the scapulohumeral rhythm in people with Frozen shoulder. Wright et al. has postulated that the mechanisms responsible for manual therapy treatment effects in the increases in ROM may feasibly involve changes in the joint, muscle, pain and motor control systems.³⁵ Joint mobilization techniques are assumed to induce various beneficial effects. The neurophysiologic effect is based on the stimulation of peripheral mechanoreceptors and the inhibition of nociceptors. The biomechanical effect manifests itself when forces are directed toward resistance but within the limits of a subject's tolerance. The mechanical changes may include breaking up of adhesions, realigning collagen, or increasing fiber glide when specific movements stress the specific parts of the capsular tissue. Due to the cause of positional faults it has been suggested as changes in the shape of articular surfaces, thickness of cartilage, orientation of fibers of ligaments and capsules, or the direction and pull of muscles and tendons. MWMs correct this by repositioning the joint, causing it to track normally. Mulligan originally postulated a "positional fault" to explain the results gained through his techniques. Such a concept would seem more applicable to pain experienced during rest while the major benefit of MWMs is the restoration of mobility and/or the alleviation of pain with movement or functional activities. The mechanisms behind the effectiveness of MWMs are based on mechanical dysfunction and therefore positional fault further mechanisms and effects that may underpin MWM techniques, including hypoalgesic and sympathetic nervous system (SNS) excitation effects.

The study shows that Gong's Group and MWM Group have shown statistically and clinically shown significant improvement in pain and shoulder abduction mobility following 3 weeks of intervention. The MWM Group subjects found clinically greater improvement in comparison to Gong's Group. Subjects in MWM Group showed reduced pain level by a VAS of -26.57% and -27.24% in Gong's Group. The participant's shoulder abduction AROM was increased by 39.78% in MWM Group and 27.72% in Gong's Group. The participant's shoulder abduction PROM was increased by 37.54% in MWM Group and 24.00% in Gong's Group.

The results indicate significant differences in VAS and shoulder abduction AROM and PROM with greater percentage of change both variables which were found to be greater in the MWM Group. The difference in improvements can be variables as the baseline parameters when pre intervention comparison of means of VAS score and ROM between the Gong's group and MWM group found that there is no statistically significant difference with small effect size. Therefore this may also interfere with the post intervention means.

Both the groups received conventional therapy consisting mobility and strengthening exercises that includes pendular exercise, isometric scapular retraction, horizontal abduction exercise, scapular stabilization exercise, strengthening rotator cuff exercise. Improvement in the outcome parameters also could be due to conventional exercises. Therefore the study is lacking with control group who received only conventional exercises, it is also lacking to find the effect with other conventional exercises such as combined Ultrasound therapy, pain relieving methods.

The study was found that the small effect size with wider range 95% CI between the groups showing small sample size that might have shown no difference between the groups. The findings in this study are based on the subjects with age of 40 to 50 years⁵ having painful stiff shoulder for at least 3 months,¹⁶ limited Active shoulder abduction ROM beyond 120 degree or less was selected.¹⁵ Therefore effects cannot be generalized with other age groups, severity, secondary frozen shoulder. Based on the purpose of the study standardized outcome measures such as pain and shoulder abduction mobility were measured but not considered changes in other ROM and functional activities. Moreover the study was carried for three weeks long term effects of both mobilization techniques cannot be predictable.

Hence based on the analysis and findings, the present study found that 3 weeks of MWM mobilization and Gong's mobilization found statistically no significant difference on improvement of pain and shoulder mobility for subjects with frozen shoulder. Therefore the study accepts null hypothesis.

CONCLUSION

The present study concludes that the 3 weeks of combined MWM with conventional exercises and Gong's mobilization with conventional exercise found statistically and clinically significant effect on improving pain, active and passive shoulder abduction ROM for subjects for frozen shoulder but there is no significant difference between both kind of mobilization on improving pain and ROM. However, clinically MWM Group was found to be more effective than Gong's Group.

It is clinically important to consider combined MWM with conventional exercises and Gong's mobilization with conventional exercise are effective for patients with frozen shoulder affected with abduction mobility.

Limitations of the study

1. Subjects with small range group between 40 to 50 years of age were considered for the study, thus results cannot be generalized to other age groups.
2. Follow-up was not done therefore long term effects were not known.
3. Only abduction ROM and pain were measured.
4. Sample size is less.

Recommendations for future research

1. Further study is lacking with control group who received only conventional exercise.
2. Study on long term effects of both mobilization techniques needed.
3. Further study should also be done to find the effect with other conventional exercise such as combined ultrasound therapy, pain, reliving methods with the mobilization technique.
4. Further study should needed measuring effect on other outcome measurements.

ACKNOWLEDGMENT

Authors were expressing their sense of gratitude's to the people who helped and encouraged them for the guidance and completion of this study.

Conflicts of Interest: None

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How to cite this article:

Mehta Bryna Pankaj, Vinod Babu. K, Sai Kumar. N, Asha D. Comparitive effect of Gong's mobilisation versus Mulligan's mobilisation on pain and shoulder abduction mobility in Frozen shoulder. *Int J Physiother Res* 2013;05:227-37.