International Journal of Yoga, Physiotherapy and Physical Education
www.sportsjournal.in
ISSN: 2456-5067
Received: 14-06-2024, Accepted: 08-07-2024, Published: 31-07-2024
Volume 9, Issue 3, 2024, Page No. 15-20

Comparison between high grade & low grade mobilization technique in patients with frozen shoulder

Shah Prem Jiteshkumar[1]*, S Aravind[2], Tejas Dutt[3]
[1] Associate Professor, Department of Musculoskeletal Physiotherapy, Vikas College of Physiotherapy, RGUHS, Mangaluru, Karnataka, India
[2] Assistant Professor, Department of Musculoskeletal Physiotherapy, Vikas College of Physiotherapy, RGUHS, Mangaluru, Karnataka, India
[3] Associate professor, Department of Musculoskeletal Physiotherapy, Khyati College of Physiotherapy, Gujarat University, Silaj, Ahmedabad, Gujarat, India

Abstract
Patients with frozen shoulder experiences pain, affected external rotation and abduction, which leads to functional disability of the affected shoulder. Currently, there has been growing interest in managing the frozen symptoms with mobilization, which is a well-accepted non-pharmacological treatment. However, research on the effects of mobilization strategies such as High Grade Mobilization (HGMT) and Low Grade Mobilization (LGMT) on pain, range of motion (ROM), and functional impairment has been unclear.
Aim: Compare the outcomes of two types of mobilization strategies: HGMT and LGMT on pain, range of motion & functional disability in unilateral frozen shoulder.
Methodology: This comparative study comprises 34 unilateral frozen shoulder cases from the age span of 40 to 60 years, regardless of gender. This study covered cases with unilateral involvement and a 50% reduction in passive mobility of the shoulder joint comparative to the non-affected side, in one or more of three movement directions. HGMT groups consist of 17 cases (50%) and they received intensive passive mobilization techniques in end-range positions of the joint (grade 3 and 4 of Maitland's classification). LGMT group includes the remaining (50%) cases and they were treated with passive mobilization techniques within the pain-free zone (grade 1 and 2). The treatment session was given for four weeks (20 sessions) in both groups. Pain using Visual Analogue Scale (VAS), Range of motion (ROM) and functional disability using Shoulder Pain and Disability Index (SPADI) were the outcome measures.
Results: Age of the 34 participants ranged from 45 to 60 years with mean 52.4 $\pm$ 5.2 years and the majority was females (52.9%). Age as well as gender was homogeneous ($p > 0.05$) according to the groups: HGMT and LGMT. There was no difference ($p > 0.05$) in the baseline measurements of functional disability, pain, flexion, abduction, as well as external rotation according to gender as well as groups. There was an improvement ($p < 0.05$) in functional disability, pain, flexion, abduction, and external rotation for entire comparisons (Baseline to 1st 2nd 3rd & 4th week; 1st week to 2nd 3rd & 4th week; 2nd week to 3rd & 4th week; 3rd week & 4th week) within HGMT group. Among LGMT group, the improvement ($p < 0.05$) was found in functional disability, pain, flexion, and abduction for entire comparisons. The external rotation for the comparisons: Baseline to 1st 2nd 3rd & 4th week; as well as 1st week to 2nd 3rd & 4th week exhibited an improvement among LGMT group. Age was positively correlated ($p < 0.05$) with flexion. The functional disability was positively correlated ($p < 0.05$) with pain during baseline within HGMT, LGMT as well as irrespective of groups. Also, flexion was positively correlated ($p < 0.05$) with abduction irrespective of groups.
Conclusion: HGMT as well as LGMT were found to be effective in management of frozen shoulder. HGMT was more effective in improving the functional disability compared to LGMT. Decline in pain was higher for LGMT group. Effectiveness in flexion as well as abduction favors more among LGMT cases as compared to HGMT. For external rotation HGMT was found to be more effective among the unilateral frozen shoulder cases.

Keywords: Frozen shoulder, shoulder disability, mobilization, adult patients

Introduction

In medical practice, the incidence of shoulder pain is estimated to be 11.2 per 1000 patients, with an annual incidence of 10 to 25 per 1000 enrolled patients [1, 2]. The probability of frozen shoulder in the general population has been found to be 2 to 5%, but in patients with diabetes it is 10 to 20% [3, 4, 5]. Frozen shoulder is categorized into three phases: freezing, frozen and thawing. Freezing phase lies between 2 to 9 months. Pain and stiffness around the shoulder are common during freezing phase. This is followed by the frozen phase, which lasts between 6 to 12 months. Night pain may persist during the frozen phase, but it often subsides as Gleno-humeral movement decreases. Spontaneous mobility recovery (thawing) occurs over the next 4 to 12 months, with full recovery typically taking longer. After the thawing phase, an objective restriction of mobility can sometimes last for several years [6, 7, 8].

The movement restrictions go in according to the capsular pattern of the glenohumeral joint. Patients commonly complain of difficulty in performing activity of daily living (ADL) [9]. There will be absence of arm swing in the affected extremity [8, 9]. In frozen shoulder, the capsule becomes inflamed & extensibility is reduced, and the axillary recess becomes adherent, thus, the flexibility of the biceps tendon in its sheath is reduced. As a result, the lateral rotation of the humeral head to pass during abduction is

severely restricted. Restoring this mechanism is the primary goal of different treatment strategies for frozen shoulder [10]. Conservative management includes non-steroidal anti-inflammatory drugs, intra-articular corticosteroid injections, and physical therapy. In severe cases, surgical management like arthroscopic release or manipulation under general anaesthesia [11]. Under physical therapy, hot water fomentation or ice applications, ultrasound, interferential therapy, transcutaneous electrical nerve stimulation, active and passive ROM exercises, mobilization techniques and proprioceptive neuromuscular facilitation (PNF) techniques, were comprehensively followed [12, 13].

Passive stretching and mobilization were few of the highly recommended physical therapy interventions for the improvement of capsule extensibility [14]. Mobilization can be performed as physiologic or accessory movement. Physiologic movements at the Gleno-humeral joint are movements of the humerus in the cardinal planes (e.g., flexion, extension, abduction, adduction, external rotation, and internal rotation). Accessory movements are passively induced by a therapist and it consist of rolling, gliding (or sliding), spinning, and distraction within the joint [15]. Intensity of mobilization techniques with rhythmic oscillatory movements are categorized based on a five grade classification (Grade-1: Small amplitude at the beginning of ROM, Grade-2: Large amplitude not reaching the end of the ROM, Grade-3: Large amplitude reaching the limited ROM, Grade-4: Small amplitude at the end of the limited ROM, Grade-5: Small amplitude and high velocity at the end of limited ROM) system of Maitland [16].

In many physical therapy programs, mobilization techniques are an important component of the intervention. Many studies have been conducted to prove the effects of different grades of mobilization along with other interventions like electro therapy modalities on a group of patient with frozen shoulder. However, role of different grades of mobilization on patients with frozen shoulder is not well defined. There has been conflicting evidence exists regarding the effect of mobilization techniques on pain and ROM when compared to other interventions.[6] Also, there is a paucity of evidence to suggest that HGMT is no more effective than LGMT for improving pain [17]. A study conducted by Henricus M Vermeulen et.al suggested that further studies are required to prove the effects of HGMT on patients affected by first stage of frozen shoulder [18]. Hence, the aim of the study was to identify "Whether High Grade Mobilization Technique (HGMT) or Low Grade Mobilization Technique (LGMT) was more effective in alleviating pain, functional disability & ROM for frozen shoulder patients?" The null hypothesis of the study was that there would be no significant difference between HGMT & LGMT on improving pain, functional disability & Shoulder ROM (flexion, abduction & external rotation), while the alternative hypothesis proposed a significant difference between HGMT & LGMT on improving these parameters in frozen shoulder patients.

Materials and Methods

This comparative study includes 34 unilateral frozen shoulder cases. HGMT groups consist of 17 frozen shoulder cases (50%) and LGMT group includes 17 patients. Both the groups received passive proprioceptive neuromuscular facilitation (PNF) techniques and Codman's pendular exercise as the basic treatment. The patients were recruited from the Physiotherapy outpatient department of Vikas College of physiotherapy. Ethical clearance and approval for the study was obtained from the institutional ethical committee. Selected patients had signed an informed consent form and the study was explained to each of the participant.

The inclusion criteria of the participants were age group 40-60 years irrespective of gender, unilateral involvement, more or equal to 50% reduction in passive movement of the shoulder joint relative to the non-affected side, in one or more of three movement directions (i.e. Abduction in frontal plane, forward flexion, or external rotation in zero of abduction). Patients with inflammatory disorders such as septic arthritis, history of uncontrolled diabetes mellitus, under steroid therapy, recent fracture or surgery in and around the shoulder joint, neuromuscular disorder, bilateral frozen shoulder patients, and unwilling to participate in the study were the exclusion criteria.

HGMT group

All the cases included in HGMT group completed the physical examination, assessment of the range of motion by performing all 3 physiologic movements of Gleno-humeral joint passively with the subject in supine position. Each of the patients received moist hot pack to reduce spasm of the surrounding muscles, after which HGMT were given to patients with intensities according to Maitland's classification grades 3 and 4. Mobilization technique was initiated with inferior glide aimed to improve extensibility of capsule and abduction by giving smooth oscillation at 2 or 3 per second for 1minute repeating twice with 1 minute of interval in between. There after posterior glide of Gleno-humeral joint was given concentrating to improve flexion and external rotation of the shoulder for 1minute repeating twice with 1 minute of interval in between. Treatment continued by giving anterior glide to improve extension and rotation movements of shoulder for 1 minute. The same is repeated twice with 1 minute of interval in between [19]. The HGMT was followed by application of passive PNF techniques aiming to improve extensibility of joint capsule. Later active pendular exercise of shoulder was given to the patients for inducing relaxation. Treatment was given 5 days in a week for 20 minutes till 4 weeks. Pain, disability and ROM were assessed after each week of the HGMT.

LGMT group

Each participant in LGMT group completed physical examination, assessment of the range of motion by performing all 3 physiologic movement of Gleno-humeral joint passively with the subject in supine position, all patients received moist hot pack to reduce spasm of the surrounding muscles, after which LGMT were given to patients with intensities according to Maitland's classification grades 1 and 2. Mobilization techniques performed in the basic starting position with translation and the distraction techniques followed with the joint near its neutral position. Once joint mobility increased, amplitude of the movement was increased without reaching the limits of ROM; the LGMT was started by giving inferior glide with rapid oscillation, like manual vibration for 1 minute. Followed by posterior and anterior glides were given without reaching end range of movement for 1 minute. Same is repeated twice with 1minute interval in between [19]. This is followed by passive PNF movements and Codman's pendular exercises to induce relaxation. Treatment was

given 5 days in a week for 20 minutes till 4 weeks. Pain, disability and ROM were analyzed after each week of the LGMT.

Moist hot pack, treatment table, dry towel, and universal goniometer were used in this study. Baseline assessment, Demographic characteristics, VAS for pain, passive and active ROM using Goniometer and functional diasability using shoulder pain and Disability Index (SPADI) were obtained from both HGMT and LGMT groups before the intervention. Pain, Range of motion (ROM) and SPADI were the outcome measures.

Outcome Measures

Shoulder Pain and Disability Index (SPADI)

The SPADI is a patient completed questionnaire with 13 items assessing pain level and extent of difficulty with daily living activities requiring the use of upper limb. The pain subscale has 5 questions and the disability subscale has 8 questions. For scoring SPADI, the patient is instructed to choose the number that best describes their level of pain and extent of difficulty using the involved shoulder. A higher score suggests more pain and disability.

Pain and ROM

Pain was assessed using VAS and assessment of the range of motion by performing all 3 physiologic movements of Gleno-humeral joint passively and actively with the subject in supine position using universal goniometer.

Sample size determination

To determine sample size, technique of estimating sample size for Paired "t" test was used [20]

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2} + \frac{(Z_{1-\alpha/2})^2}{2}$$

Where,

$\alpha =$ Significance level (5%)

$\Delta =$ Effect size (0.75)

$1-\beta =$ Power (80%)

$$n = \frac{(1.96 + 0.84)^2}{0.75^2} + \frac{(1.96)^2}{2} = 16$$

Anticipated drop outs (5%)

Thus, the minimum number of subjects required for this study is 16 + 1 = 17 (Each group).

Statistical Analysis

The collected data were summarized by using the Descriptive Statistics: frequency, percentage, mean and S.D. The Independent sample "t" test was used to compare age, disability, pain, flexion, abduction, and external rotation between groups: HGMT and LGMT as well a gender. Chi square test was used to compare gender between the groups. The repeated measure ANOVA was used to compare disability, pain, flexion, abduction, and external rotation irrespective of groups as well as within the groups. Pairwise comparisons of disability, pain, flexion, abduction, and external rotation were analyzed by using Bonferroni test. The Pearson correlation coefficient ("r") was used to find the relation between age and the baseline measurements of disability, pain, flexion, abduction, and external rotation. The p value < 0.05 was considered as significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 26.0.

Results

A total of 34 participants were screened as per the selection criteria; out of which 32 met the inclusion criteria. Participants were randomly assigned into two groups i.e. Group A (n = 17) and Group B (n = 17). Demographic data of the participants are shown in Table 1. The data were homogenous among the groups for age, gender & the outcome variables.

The repeated measures ANOVA was used ti compare disability, pain, flexion, abduction, & external rotation within the groups. There was a significant difference ($p < 0.05$) in disability, pain, flexion, abduction & external rotation from baseline to 4th week of interventions within both HGMT & LGMT groups. Hence, both the mobilisation techniques were effective for all the outcomes (Table 2)

The effectiveness (Mean difference) of disability was found to be higher among HGMT group compared to LGMT group for the comparisons baseline to 1st 2nd 3rd & 4th week; 1st week to 2nd 3rd & 4th week; 2nd week to 3rd & 4th week; as well as 3rd week & 4th week. [Table – 3] It indicates that HGMT was more effective in improving the disability compared to LGMT among the frozen shoulder cases

Regarding pain, the mean difference was higher for LGMT group compared to HGMT group for the comparisons baseline to 1st 2nd 3rd & 4th week; 1st week to 2nd 3rd & 4th week; 2nd week to 3rd & 4th week; as well as 3rd week & 4th week. [Table – 3] Hence, LGMT was more effective in improving the pain compared to HGMT among the frozen shoulder cases.

The effectiveness in flexion was more among LGMT cases compared to HGMT cases for the comparisons baseline to 3rd & 4th week; 1st week to 2nd 3rd & 4th week; 2nd week to 3rd & 4th week; as well as 3rd week & 4th week. [Table – 3] It indicates that for flexion LGMT was more beneficial than HGMT.

The effectiveness identified for abduction favours LGMT for the comparisons baseline to 1st 2nd 3rd & 4th week; 1st week to 2nd 3rd & 4th week; 2nd week to 3rd & 4th week; as well as 3rd week & 4th week.

For external rotation more improvement found among HGMT compared to LGMT. [Table–3] Hence, for abduction LGMT was more effective and for external rotation HGMT was found to be more effective among unilateral frozen shoulder cases.

Table 1: Demographic data of the participants

Variables	HGMT	LGMT	p value
Age (years)	52.7±5.2	52.1±5.3	0.747
Sex (male/female)	9/8	7/10	0.492
Disability	58.2+7.7	57.6+7.3	0.457
Pain	6.4 ± 1.0	6.5 ± 1.3	0.977
Flexion	121.9 ± 17	108.2±12.5	0.608
Abduction	83.1±17	83.6±16.3	0.586
External rotation	17.9±7.0	22.3±8.2	0.716

Table 2: Comparison of changes in Disability, Pain & flexion, abduction, and external rotation within the groups

		HGMT				LGMT			
		Mean	**S.D.**	**"F"**	**p value**	**Mean**	**S.D.**	**"F"**	**p value**
Disability	Baseline	58.2	7.7	93.60	< 0.001*	57.6	7.3	216.88	< 0.001*
	1 Week	48.2	6.3			51.7	7.7		
	2 Week	38.0	8.9			45.9	8.7		
	3 Week	31.1	10.2			39.2	8.5		
	4 Week	23.4	8.6			33.7	8.2		
Pain	Baseline	6.4	1.0	145.67	< 0.001*	6.5	1.3	194.75	< 0.001*
	1 Week	3.6	1.5			3.5	2.1		
	2 Week	3.2	1.9			2.4	1.4		
	3 Week	2.5	1.0			2.3	1.4		
	4 Week	2	1.2			2.2	1.6		
Flexion	Baseline	121.9	17.0	79.05	< 0.001*	108.2	12.5	73.01	< 0.001*
	1 Week	135.4	14.6			121.8	10.8		
	2 Week	142.3	12.8			141.8	10.8		
	3 Week	152.3	10.9			151.8	10.8		
	4 Week	22.4	5.0			15.9	5.2		
Abduction	Baseline	83.1	17.0	117.93	< 0.001*	83.6	16.3	56.77	< 0.001*
	1 Week	96.9	16.5			98.2	13.3		
	2 Week	109.6	15.5			113.6	15.0		
	3 Week	120.0	14.3			122.7	15.6		
	4 Week	128.5	14.6			130.9	13.8		
External Rotation	Baseline	17.9	7.0	89.02	< 0.001*	22.3	8.2	35.76	< 0.001*
	1 Week	27.1	6.1			31.8	9.0		
	2 Week	31.8	5.8			36.8	7.8		
	3 Week	37.1	4.7			40.9	4.9		
	4 Week	41.4	4.6			43.6	2.3		

Table 3: Pairwise comparisons of disability, pain, flexion, abduction, and external rotation within the groups

Pairwise comparisons			**HGMT**			**LGMT**		
			Mean Difference	**p value**	**95% C.I. for Difference**	**Mean Difference**	**p value**	**95% C.I for Difference**
Disability	Baseline	1 Week	9.9	< 0.001*	4.58 to 15.27	5.8	< 0.001*	2.97 to 8.67
		2 Week	20.2	< 0.001*	10.94 to 29.37	11.6	< 0.001*	7.42 to 15.85
		3 Week	27.1	< 0.001*	16.50 to 37.66	18.4	< 0.001*	13.53 to 23.20
		4 Week	34.8	< 0.001*	24.43 to 45.11	23.8	< 0.001*	19.29 to 28.34
	1 Week	2 Week	10.2	< 0.001*	4.96 to 15.50	5.8	< 0.001*	3.96 to 7.68
		3 Week	17.2	< 0.001*	10.63 to 23.68	12.5	< 0.001*	9.63 to 15.46
		4 Week	24.8	< 0.001*	18.69 to 31.01	18.0	< 0.001*	15.27 to 20.73
	2 Week	3 Week	6.9	< 0.001*	3.71 to 10.14	6.7	< 0.001*	4.36 to 9.10
		4 Week	14.6	< 0.001*	10.92 to 18.31	12.2	< 0.001*	9.78 to 14.59
	3 Week	4 Week	7.7	< 0.001*	4.44 to 10.95	5.5	< 0.001*	2.88 to 8.03
Pain	Baseline	1 Week	5.8	< 0.001*	3.53 to 8.00	6.9	< 0.001*	4.29 to 9.53
		2 Week	10.7	< 0.001*	7.55 to13.83	14.4	< 0.001*	8.19 to 20.53
		3 Week	15.5	< 0.001*	10.51 to 20.41	20.5	< 0.001*	15.99 to 24.92
		4 Week	19.5	< 0.001*	15.10 to 23.98	26.8	< 0.001*	22.02 to 31.62
	1 Week	2 Week	4.9	< 0.001*	3.30 to 6.55	7.5	< 0.001*	3.35 to 11.56
		3 Week	9.7	< 0.001*	6.21 to 13.17	13.5	< 0.001*	10.88 to 16.21
		4 Week	13.8	< 0.001*	10.89 to 16.65	19.9	< 0.001*	16.55 to 23.27
	2 Week	3 Week	4.8	< 0.001*	2.37 to 7.17	6.1	< 0.001*	3.34 to 8.84
		4 Week	8.8	< 0.001*	6.56 to 11.14	12.5	< 0.001*	8.61 to 16.30
	3 Week	4 Week	4.1	< 0.001*	2.28 to 5.88	6.4	< 0.001*	4.54 to 8.19
Flexion	Baseline	1 Week	-15.0	< 0.001*	-22.3 to -7.74	-13.6	< 0.001*	-19.1 to -8.19
		2 Week	-28.5	< 0.001*	-38.1 to -18.88	-27.3	< 0.001*	-40.1 to -14.4
		3 Week	-35.4	< 0.001*	-49.3 to -21.46	-47.3	< 0.001*	-64.8 to -29.8
		4 Week	-45.4	< 0.001*	-60.2 to -30.54	-57.3	< 0.001*	-77.8 to -36.7
	1 Week	2 Week	-13.5	< 0.001*	-19.08 to -7.84	-13.6	0.006*	-23.6 to -3.65
		3 Week	-20.4	< 0.001*	-29.0 to -10.98	-33.6	< 0.001*	-49.1 to -18.2
		4 Week	-30.4	< 0.001*	-41.4 to -19.33	-43.6	< 0.001*	-62.5 to -24.8
	2 Week	3 Week	-6.9	0.027*	-13.22 to -0.62	-20.0	< 0.001*	-28.4 to -11.6
		4 Week	-16.9	< 0.001*	-25.28 to -8.57	-30.0	< 0.001*	-43.7 to -16.3
	3 Week	4 Week	-10.0	< 0.001*	-15.14 to -4.87	-10.0	0.016*	-18.4 to -1.64
Abduction	Baseline	1 Week	-13.8	< 0.001*	-20.03 to -7.66	-14.5	< 0.001*	-20.2 to -8.91
		2 Week	-26.5	< 0.001*	-33.9 to -19.18	-30.0	< 0.001*	-42.8 to -17.2
		3 Week	-36.9	< 0.001*	-46.9 to -26.92	-39.1	< 0.001*	-54.7 to -23.5
		4 Week	-45.4	< 0.001*	-57.4 to -33.35	-47.3	< 0.001*	-64.8 to -29.8
	1 Week	2 Week	-12.7	< 0.001*	-18.71 to -6.67	-15.5	0.018*	-28.6 to -2.35

		3 Week	-23.1	< 0.001*	-31.4 to -14.72	-24.5	0.001*	-39.32 to-9.77
		4 Week	-31.5	< 0.001*	-40.9 to -22.15	-32.7	< 0.001*	-49.5 to -15.9
	2 Week	3 Week	-10.4	< 0.001*	-15.32 to -5.45	-9.1	0.016*	-16.7 to -1.53
		4 Week	-18.8	< 0.001*	-26.9 to -10.81	-17.3	0.001*	-27.04 to-7.51
	3 Week	4 Week	-8.5	0.002*	-14.08 to -2.84	-8.2	0.047*	-16.29 to-0.08
External Rotation	Baseline	1 Week	-9.3	< 0.001*	-12.76 to -5.81	-9.5	0.001*	-15.2 to -3.91
		2 Week	-13.9	< 0.001*	-19.28 to -8.57	-14.5	0.001*	-22.3 to -6.74
		3 Week	-19.3	< 0.001*	-24.8 to -13.74	-18.6	< 0.001*	-25.9 to -11.4
		4 Week	-23.6	< 0.001*	-29.8 to -17.34	-21.4	< 0.001*	-30.1 to -12.6
	1 Week	2 Week	-4.6	0.023*	-8.78 to -0.51	-5.0	0.041*	-9.83 to -0.17
		3 Week	-10.0	< 0.001*	-14.33 to -5.67	-9.1	0.011*	-16.3 to -1.92
		4 Week	-14.3	< 0.001*	-19.24 to -9.33	-11.8	0.012*	-21.3 to -2.38
	2 Week	3 Week	-5.4	0.003*	-9.09 to -1.62	-4.1	0.552	-10.84 to 2.66
		4 Week	-9.6	< 0.001*	-14.47 to -4.81	-6.8	0.131	-14.93 to 1.29
	3 Week	4 Week	-4.3	< 0.001*	-6.70 to -1.88	-2.7	0.251	-6.44 to 0.99

(* Significant; C.I = Confidence Interval)

Discussion

This study was conducted to identify "Whether High Grade Mobilization Technique (HGMT) or Low Grade Mobilization Technique (LGMT) was more effective in alleviating pain and disability for patient with frozen shoulder?" Despite, the study rejected null hypothesis and accepted alternate hypothesis that there may be a significant difference between the effects of HGMT and LGMT, the results does not support any significant difference in alleviating pain and improving disability when compared to each other. However, the improvement in disability was found to be higher among HGMT group as compared to LGMT group. The decline in pain was higher for LGMT group. Effectiveness in flexion as well as abduction favors more among LGMT cases as compared to HGMT cases. For external rotation HGMT was found to be more effective among unilateral frozen shoulder cases. Furthermore, both the mobilization techniques were effective in alleviating pain and disability for frozen shoulder cases within both the HGMT and LGMT groups.

It is evident that there is no link between both the mobilization techniques as one is given by taking limb to end range (HGMT) and another is given within the available range (LGMT) [21]. The study focus on a first stage of frozen shoulder population which has more of pain issues comparing stiffness related problems. LGMT is concentrated more on pain relief by inhibiting the perception of painful stimuli by repetitively stimulating mechanoreceptors that block nociceptive pathways at the spinal cord or brain stem levels. Whereas, HGMT is concentrated more on stretching the joint structure and thereby increase the joint play [22].

This study investigated improvement in range of flexion, abduction, and external rotation from baseline to post 4th week of treatment. According to experimental hypothesis of the study there should be more improvement achieved in HGMT group as compare to LGMT group, but in contrast to it LGMT group shows more improvement in flexion compare to HGMT. Similarly, when comparing abduction and external rotation it showed more improvement in HGMT group than LGMT. In this study, there was a difference ($p < 0.05$) in disability (4th week), pain (4th week), and external rotation (3rd week) between groups: HGMT and LGMT. For all other comparisons (Between groups), there was no difference ($p > 0.05$) in disability, pain as well as external rotation between HGMT and LGMT groups. Main reason behind improving flexion ROM can be because of application of posterior glide; in this study posterior glide is given to both the groups for equal duration still more improvement is found in LGMT group. Another reason for finding different values in both the groups can be subjective or based on progression of condition in patient because of which prognosis varies [23]. However, comparing abduction and external rotation movements between both groups, it shows more improvement in HGMT group. In spite of the negligible difference between both HGMT and LGMT groups, this study recommends more studies with the mobilisation techniques.

In this study, selection criteria were based on the inclusion of patients with stage 1 frozen shoulder. In these patients, severe limitation of the passive mobility of the Gleno humeral joint is prominent due to pain and stiffness around the joint in the end-range of the ROM. The subjects might experience a relatively 7 to 9 months of complaints. Thus, result of this study cannot be generalized to all patients with various stages of frozen shoulder. Also, more stratified samples such as five grade classification system of Maitland would result predicted comparison between HGMT and LGMT.

So, HGMT and LGMT were found to be effective in the management of frozen shoulder. HGMT was more effective in improving the disability compared to LGMT. Decline in pain was higher for LGMT group. Effectiveness in flexion as well as abduction favors more among LGMT cases as compared to HGMT cases. For external rotation HGMT was found to be more beneficial among unilateral frozen shoulder cases.

References

1. Yogesh V, Deepak BA, Dhiraj RS, Jayanth T. Short term effectiveness of kalternborn mobilization in adhesive capsulitis: A randomized control trial. IJBAMR,2013:2(8):932-938.
2. Armstrong JR. Excision of the acromion in the treatment of supra spinatus syndrome. Report of 95 exercises. J Bone Joint Surgery Br,1949:31:436–432.
3. Grubbs N. Frozen shoulder syndrome – a review of literature. JOSPT, 1993, 18.
4. Ozaki J, Nakagawa Y, Sakurai G, Tamai S. Recalcitrant chronic adhesive capsulitis of the shoulder. Role of contracture of the coracohumeral ligament and rotator interval in pathogenesis and treatment. J Bone Joint Surg Am,1989:71:1511-1515.
5. Pal B, Anderson I Dick WC, Griffiths ID. Limitation of joint mobility and shoulder capsulitis in insulin and

noninsulin dependent diabetes mellitus Br I Rheumatol,1986:25:147–151.
6. Baslund B. Frozen shoulder current concepts. Scandivanian J Rheumatology,1990:19:321-325.
7. Dias R, Cutts S, Massoud S. Clinical review frozen shoulder. BMJ,2005:331:1453-1456.
8. Reeves B. The natural history of the frozen shoulder. Scandinavian Jour Rheumatol,1975:4:193-196.
9. Kesler RM, Hertling D. Management of common Musculo-skeletal Disorders, Philadelphia, Lippincott Williams & Wilkins, 2006, 112-120
10. Corrigan B, Maitland GD. Practical Orthopeadic Medicine. London, United Kingdom: Butterworths, 1983, 120-128
11. Bertoft ES. Painful shoulder disorders from a physiotherapeutic view: a review of literature. Critical Reviews in Physical and Rehabilitation Medicine,1999:11:229–277.
12. Arslan SC¸ Eliker R. Comparison of the efficacy of local corticosteroid injection and physical therapy for the treatment of adhesive capsulitis. Rheumatol Int,2001:21:20–23.
13. Carette S, Moffet FN, Tardif J, *et al*. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder. Arthritis Rheum,2003:48:829–838.
14. Yang JI, Chang CW. Randomized Multiple-Treatment Trial- Mobilization Techniques in Subjects with Frozen Shoulder Syndrome. Physther,2007:87:1307-1315.
15. Kaltenborn FM. Manual Therapy for the Extremity Joints. 2nd ed. Oslo, Norway: Olaf NorlisBokhandel, 1976.
16. Mangus BC, Hoffman LA, Hoffman MA, Altenburger P. Basic principles of extremity joint mobilization using a Kaltenborn approach. Journal of Sport Rehabilitation,2002:11:235–250.
17. Chung Yee Cecilia Ho a, Gisela Sole a, Joanne Munna. The effectiveness of manual therapy in the management of musculoskeletal disorders of the shoulder: A systematic review. Manual Therapy,2009:14:463–474.
18. Henricus MV. Comparative study on effect of HGMT and LGMT,2006:86:355-368.
19. Kisner. Colby's 5th edition, Therapeutic exercise: foundation and techniques, 116-125.
20. Machin D, Campbell MJ, Fayers MP, Pinal APY. Sample size tables for clinical studies. Blackwell science Ltd. Second Edition, 1997.
21. Hayes K, Walton JR, Szomor ZL, Murrell GAC. Reliability of five methods for assessing shoulder range of motion. Australian Journal of Physiotherapy,2001:47:289-294.
22. Ekeberg OM, Holter EB, Tveitå1 EK, Keller A, Juel NG, Brox JI. Agreement, reliability and validity in 3 shoulder questionnaires in patients with rotator cuff disease, BMC Musculoskeletal Disorders, 2008, 9- 68.
23. Baums MH, Spahn G, Nozaki M, Steckel H, Schultz W, Klinger HM. Functional outcome and general health status in patients after arthroscopic release in adhesive capsulitis. Sports Traumatol Arthrosc,2007:15(5):638-44.