International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 21s, 2025
https://theaspd.com/index.Php

Compare The Effectiveness Of Angular Joint Mobilization Versus Three Directional Manual Capsular Stretching Exercise On Pain, Range Of Motion And Functional Disability In Patient With Periarthritis Shoulder

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ABSTRACT

Background: *PA Shoulder is considered to be a self-limiting condition with symptoms lasting from few months to two years. Lack of capsular flexibility is one of the most important pathologic mechanisms that result in large mobility deficits. Consequently, restoration of GH motion is important clinical practice for patients with PA shoulder because most of the daily activities are primarily depends on shoulder. As a result, the most recent advanced techniques are required to treat the patient with PA shoulder[5].* ***Objective:*** *The study objective was to compare the effectiveness of Angular joint mobilization versus Three directional manual capsular stretching exercise on pain, Range of motion and functional disability in patient with periarthritis shoulder.*

Methods: *For this study, 40 patients diagnosed with PA shoulder from the outpatient department of physiotherapy, Mahatma Gandhi Medical College and Research Institute (MGMCRI) were selected by convenient method based on selection criteria and equally divided into 2 groups. Group A patients were treated with AJM. Group B patients were treated with manual capsular stretching for the tightened anterior, inferior and posterior capsules of the shoulder. Both techniques were given for a period of 20 minutes per session, 3 alternative days a week for 3 weeks, a total of nine sessions. And outcome measure tools used for this study were the NPRS, goniometry, New Oxford Shoulder Score and Hand Behind Back Test to collect data for this study.*

Results: *The result of the analysis shows that there was a significant improvement in pain, ROM, functional disability and HBB in Both techniques P of 0.001.*

Conclusion: *The study concluded that the Angular joint mobilization is more effective in reducing pain, increasing range of motion and improving function in patients with periarthritis shoulder.*

Keywords: *Angular Joint Mobilization, Manual Capsular Stretching, Periarthritis Shoulder, New Oxford Shoulder Score, Hand Behind Bach Test.*

1. INTRODUCTION

PA Shoulder is a common disabling but self-limiting condition by progressive fibrosis to ultimate contracture of the GH joint[4]. Characterized by pain and loss of both active and passive mobility of the GH joint[5]. The annual incidence is 2-5% in general population and even upto40% in patients with DM. It mainly affects the people between 40-60 years of age. Women are more commonly affected than men, Primary PA Shoulder is idiopathic and secondary PA Shoulder is defined as one associated with trauma, cardiovascular, Rotator cuff disorders, Impingement, Hemiparesis and DM. Some school of thought classify PA Shoulder with DM as primary[6]. The most common limitation in the ROM are External rotation, Abduction, Internal rotation and Flexion with spontaneous restoration of the partial or complete motion over few months to two years[7,8]. The loss of External rotation ROM with arm at the side is a hallmark of this condition[9]. Its clinical course divided into inflammatory, freezing, frozen and thawing stage. Gradual onset of pain persists less than 3 months and no loss of ROM in stage I. Nocturnal pain with significant loss ROM in all direction extend upto 3-9 months in stage II. Pain present at end ROM or at night, capsular pattern is severely restricted and extend up to 9-14 months in stage III. Gradual improvement in ROM due to capsular remodeling occurs between 15-24 months in stage IV[9]. In 2nd and 3rd stage of PA patients are complaints of inability to reach into the back pocket,

comb the hair, wash the opposite shoulder and difficulty in reaching behind the back. When performing this activity sharp acute pain and discomfort can occurs as a result of tight capsules[3].

Manual Capsular Stretching (MCS) is a therapeutic Maneuver designed to lengthen the pathologically shortened soft tissue by using external force applied manually and there by facilitate increase in ROM. Capsular Stretching also causes significant reduction in pain and improvement shoulder function in patients with PA Shoulder[9,10].

Rotatory Movement also referred to as rotary motion, in biomechanical terminology is called 'angular displacement' (osteokinematic view) which is movement of a segment around a fixed axis. Baeyens et al., theorized that joint restriction was due to impaired rotation with possible joint axis shift impairment of the rotary motion joint and then the author revised the idea of joint mobilization and named it **Angular Joint Mobilization** (AJM) Which is rotational joint mobilization with joint axis shift[4].

Lack of capsular flexibility is one of the most important pathologic mechanisms that result in large mobility deficits. Consequently, restoration of GH motion is important clinical practice for patients with PA shoulder because most of the daily activities are primarily depends on shoulder. As a result, the most recent advanced techniques are required to treat the patient with PA shoulder[5]. There is a vast literature on the efficacy of various physiotherapy modalities, self-stretching, active exercise, dry needling, mulligan and maitland mobilization for PA shoulder[6]. However, one of the most important current and new treatment option for PA shoulder is Angular Joint Mobilization and the effectiveness of Three directional manual Capsular Stretching studies are limited[6]. No one studies to compare the effectiveness of AJM and MCS. Hence the purpose of this study was to compare the effectiveness of AJM Vs Three directional MCS exercise in patients with PA shoulder.

2. METHODOLOGY

It is a comparative study pretest post-test design in which 40 Patients were selected with the diagnosed Unilateral involvement of Primary PA Shoulder, Duration of condition between 4-12 months, both male and females and the age group between 40-60 years were included in this study. Intra articular corticosteroid injection to the affected shoulder within last 3 months and History of any previous surgery on the affected shoulder were excluded from this study. After obtaining written consent from the patient They were conveniently and equally divided into two group (Group A & Group B) and explained about the detailed treatment procedure. The dependent variables are shoulder pain, ROM, Hand behind back and shoulder functional disabilities were assessed by NPRS, Goniometry, HBB test and New Oxford shoulder score. Group A patients were treated with Angular joint mobilization and Group B patients were treated with Three directional MCS exercise for the tightened anterior, inferior and posterior capsules of the shoulder. Both techniques were given for a period of 20 minutes per session, 3 alternative days a week for 3 weeks, a total of nine sessions. Before the initiation of treatment wax therapy were given to both the groups. All the patients of both the group A&B were taught home exercise program like codman's pendulum exercise, Wand exercise, finger ladder and Towel exercise. Pre and Post outcome measure scores were recorded for both group and the datum were statistically analyzed.

3. TREATMENT PROCEDURE

3.1ANJULAR JOINT MOBILIZATION

3.1.1 AJM to improve flexion and abduction

Position of patient is supine lying, techniques were applied in long lever arm. Asked the patient to flex the shoulder at available range (joint axis shift) then manually performed grade 1 rotatory oscillations were applied with slight overpressure at start of the pathological limit in both directions. Passively flexed the shoulder to further more and progress to performed grade 2 rotatory oscillations were applied in both directions. Finally progressed to end range of flexion and performed grade 3 rotatory oscillations at the end of the pathological limit in both directions.

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Fig 1: AJM for flexion

Fig 2: AJM for abduction

3.1.2 AJM to improve internal & external rotation

Position of patient is supine lying, these techniques were applied in short lever arm (shoulder 90° abduction and elbow 90° flexion). The procedures were followed same as in flexion and abduction. However, to increase internal rotation of the shoulder, Rotatory oscillations were applied in medial direction as well to increase external rotation of shoulder, rotatory oscillations were applied in lateral direction. All the grades were applied in one by one; 4 to 5 rotatory oscillations were applied within 5 minute in both directions. 5 minutes each of flexion, abduction, internal and external rotation for a total of 20 minutes per session, 3 sessions per week for 3 weeks.

Fig 3: AJM for internal rotation

Fig 4: AJM for external rotation

3.2MANUAL CAPSULAR STRETCHING

3.2.1 Anterior capsular stretching

To stretch the anterior capsule the patient was positioned either in side lying with affected arm upward or in high sitting position based on patient's comfort. The shoulder and arm were passively brought into extension with elbow flexion then stretch the anterior capsule by further more extension until a stretch is felt at the front of the shoulder. Hold it for 10 seconds repeat it for 5 times per session, 3 sessions per week for 3 weeks.

Fig 5: Anterior capsular stretching

3.2.2 Posterior capsular stretching

The patient was positioned in high sitting and performed cross body adduction of the involved arm passively then given some pressure to the end range until a stretch is felt at the back of the shoulder.

Fig 6: Posterior capsular stretching

Fig 7: Inferior capsular stretching

3.2.3 Inferior capsular stretching

The patient was positioned in high sitting then passively hold the involved arm over head with the elbow flexed position and stretch the inferior capsule with a downward force.

4. DATA ANALYSIS

The statistical tool used were Wilcoxon signed rank test, Paired sample 't' test, Mann Whitney U test and independent sample 't' test. The Shapiro wilk test of normality was used to identify the right statistical tests (parametric or non-parametric). The entire statistical analysis was carried out using the statistical package of the social sciences (SPSS - 21).

TABLE 1: COMPARISION OF PAIN BY NPRS -WITHIN GROUP ANALYSIS

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z Value	p
	Value	p			value	P				
AJM (G-A)	0.80	0.001	6.20	0.77	0.86	0.001	3.40	0.82	4.18	0.001*
MCS (G-B)	0.79	0.001	6.10	0.85	0.77	0.001	4.35	0.75	4.13	0.001*

TABLE 2: FLEXION ROM -WITHIN GROUP ANALYSIS

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	P
	Value	p			value	P				
AJM	0.94	0.257	120.50	22.47	0.94	0.244	146.25	18.63	18.79	0.001*
MCS	0.92	0.115	115.25	25.93	0.94	0.226	126.50	24.39	11.83	0.001*

TABLE 3: ABDUCTION ROM - WITHIN GROUP COMPARISON

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	p
	Value	p			value	p				
AJM	0.89	0.038*	106.75	19.21	0.96	0.610	132.75	19.49	3.99	0.001*
MCS	0.89	0.024*	106.75	22.84	0.94	0.235	117.50	22.39	3.98	0.001*

TABLE 4: INTERNAL ROTATION ROM - WITHIN GROUP COMPARISON

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	P
	Value	p			value	p				
AJM	0.93	0.182	34.25	9.22	0.95	0.457	56.25	8.47	17.96	0.001*
MCS	0.93	0.138	42.25	7.34	0.93	0.155	52.00	6.77	22.13	0.001*

TABLE 5: EXTERNAL ROTATION ROM - WITHIN GROUP COMPARISON

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	p
	Value	p			value	P				
AJM	0.95	0.399	31.00	9.81	0.96	0.563	54.25	8.47	23.76	0.001*
MCS	0.88	0.015*	36.75	8.31	0.90	0.046*	46.25	7.23	4.13	0.001*

TABLE 6: NEW OSS - WITHIN GROUP COMPARISON

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	p
	Value	p			value	P				
AJM	0.88	0.018	25.90	5.96	0.94	0.189	38.70	5.22	3.95	0.001*
MCS	0.94	0.198	23.45	3.82	0.94	0.237	31.20	3.83	26.01	0.001*

TABLE 7: HBB - WITHIN GROUP COMPARISON

PAIN	PRE				POST					
	Shapiro Wilk		Mean	S. D	Shapiro Wilk		Mean	S. D	t/z value	p
	Value	p			value	P				
AJM	0.95	0.341	57.35	3.38	0.95	0.398	36.45	5.36	21.85	0.001*

MCS	0.95	0.430	51.95	5.52	0.97	0.670	42.05	6.13	15.77	0.001*

TABLE 8: COMPARISON OF PAIN BETWEEN GROUPS

PAIN	**Shapiro Wilk**		**Mean Difference**	**t/z value**	**P**
	value	**P**			
AJM	0.49	0.001*	2.28±0.68	5.06	0.001*
MCS	0.54	0.001*			

TABLE 9: SHOULDER ROM – BETWEEN GROUPS COMPARISON

ROM (Degrees)	**Shapiro Wilk**		**Mean Difference**	**Z Value**	**P**
	value	**p**			
Flexion					
AJM	0.90	0.048*	18.50 ± 9.00	5.18	0.001*
MCS	0.84	0.004*			
Abduction					
AJM	0.88	0.015*	18.36 ± 9.89	4.91	0.001*
MCS	0.82	0.002*			
Internal Rotation					
AJM	0.89	0.033*	15.88 ± 7.41	5.42	0.001*
MCS	0.55	0.001*			
External Rotation					
AJM	0.85	0.006*	16.38 ± 7.92	5.47	0.001*
MCS	0.62	0.001*			

TABLE 10: NEW OSS COMPARISON- BETWEEN GROUPS

OSS	**Shapiro Wilk**		**Mean Difference**	**t/z value**	**P**
	value	**P**			
AJM	0.84	0.004*	10.28 ± 3.04	5.45	0.001*
MCS	0.89	0.039*			

TABLE 11: COMPARISON OF HBB - BETWEEN GROUPS

HBB	**Shapiro Wilk**		**Mean Difference**	**t/z value**	**P**
	value	**P**			
AJM	0.94	0.285	20.90±4.28	9.61	0.001*
MCS	0.92	0.102			

5. RESULT

In this study comparison of pain between group analysis showed that the pain has reduced with a mean difference of 0.49 by AJM and 0.54 by MCS with P value 0.001(table 8), comparison of ROM between group analysis showed that flexion has improved with a mean difference of 0.90 by AJM and 0.84 by MCS with P-value 0.001, abduction has improved with a mean difference of 0.88 by AJM and 0.82 by

MCS, internal rotation has improved with mean difference of 0.89 by AJM and 0.55 by MCS, external rotation has improved with mean difference of 0.85 by AJM and 0.62 by MCS with P-value 0.001(table 9), comparison of New OSS between group analysis showed that the shoulder pain and functional disability has reduced with a mean difference of 0.84 by AJM and 0.89 by MCS (table 10), and comparison of HBB between group analysis showed that indirect method of internal rotation has improved with mean difference of 0.94 by AJM and 0.92 by MCS (table 11) with P-value 0.001. A comparative study between pre & post data on Group A and Group B showed a significant difference in the effectiveness of pain, abduction and external rotation with P-value 0.0001. It indicates that AJM group (A) has shown higher improvement in NPRS, ROM, OSS and HBB compared to MCS group (B) and the difference was statistically significant. The statistical significance level was determined at <0.05.

6. DISCUSSION

PA Shoulder mainly affects the people between 40-60 years of age. Women are more commonly affected than male. The findings of the current study, majority of PA Shoulder patients were belongs to the age group of 51-60 years (60%). About the gender of the PA Shoulder 57.5% (23) of the patients were female. 40% (16) of the home makers and 35% (14) of the farmers were affected with PA Shoulder. In the study it was found that PA Shoulder was reported to be more common in women especially between the age group of 51-60. This is accordance to the study done by Shivakumar et al., (2014). Numerous studies were conducted on the age group between 40-65 years [7,9,10,16,17,22] and female patients were the maximum for this condition [13,17]. There are conflicting opinions about whether PA Shoulder is more likely to develop in the dominant or non-dominant arm. Findings of the current study 60% (24) patients were affected with non-dominant side PA Shoulder. Remaining 40% (16) patients were affected with dominant shoulder. In 2018 Toda et al., concluded that the non-dominant shoulder was affected more than the dominant shoulder. These findings support the current study. Another study in 2021 Tariq et al., studied the effect of cyriax inferior capsule stretching in idiopathic adhesive capsulitis. Mean value of the patient with right sided PA shoulder was 67.9% and left sided PA shoulder was 32%. This study contradicts with the current study. The annual incidence of PA Shoulder is 2-5% in general population and even up to 40% in patients with DM. Findings of the current study was 65% (26) of patients were affected with DM,15%(6) of the patients were affected with hypothyroidism and 12.5% of the patients were affected with idiopathic PA Shoulder. In 2011 Neviaser et al., study claimed that women are commonly affected furthermore positive family history and co-morbid such as uncontrolled glucose level increases the risk of Frozen shoulder. This finding supports the current study. Duzgun et al., (2012) Found that no difference between DM and non-DM shoulder parameters in both before and after treatment. AJM is designed for the stretching of contracted muscles, capsules and ligaments by joint axis shift and break the adhesion or fibrosis of the capsule by giving assistive joint mobilization in both directions. The biomechanical effect manifest itself when force is directed towards resistance but within the limits of patient's tolerance. Most of the force is applied to the movement restricted ROM. This technique improves ROM by break or rupture adhesion around the joint capsule it leads improve the circulation, nutrition, enhance synovial fluid distribution for good lubrication also improve lymphatic flow from the treatment area. Results in regain ROM and also recovers the arthrokinematics movement.[23] The findings of the study were supported by a previous case report conducted by Kim et al., (2017) documented that AJM is effective and produce immediate relieve in pain, shoulder disability and improving ROM in frozen shoulder survivors. Another study conducted by Seung et al., (2018) found that AJM has positive effect on the improvement of shoulder pain, ROM and function in a patient with shoulder adhesive capsulitis. The present study reported capsular stretching is a therapeutic maneuver designed to increase mobility of soft tissues and subsequently improve ROM by elongating structures that have shortened by adhesion (most often inferior part) cause capsular insufficiency and have become hypomobile over time [9]. This length can be restored by specific stretching technique directed to the appropriate capsule. It reduces intra articular pressure and promote separation of the articular surface also enhance the release of synovial fluids hence facilitate capsule nourishment [6]. The reason for these improvements implies that the effect of physiological mechanism behind the changes in soft tissue extensibility, viscoelastic property of soft tissues. It leads to increased ROM at the joint. The mechanical changes may include breaking of adhesion and realigning collagen [10]. Similarly, a recent study done by Hagiwara et al., (2020) added that as each segment of joint capsule effect ROM in all

directions of shoulder movement. Hence in order to regain joint motion whole joint capsular release will produce desire effect in PA patients.

Another study suggested that posterior capsular stretch along with mobilization plays very important role in management of adhesive capsulitis[14]. A study by Paul et al., (2014) showed that manual therapy with capsular stretch was more effective than manual therapy alone. In the current study active exercise are taught as a home program. Active exercise within the pain free ROM stimulates mechanoreceptors and decrease pain. It maintains physiological elasticity and contractility of the muscles. It provides sensory feedback from the contracting muscles. It also provides a stimulus for bone and joint tissue integrity [9].A study by Nicholson showed active exercises were found to be more effective. Additionally various studies included active exercise as a home program [9,10]. This study finding was strongly supported by Noureen et al., (2021) compared the efficacy of 3 directional capsular stretching Vs AJM on 50 patients with frozen shoulder were equally divided into two groups. Group A received active capsular stretching. Group B received AJM. The author concluded that AJM is significantly more effective in reducing shoulder pain, functional limitation and disabilities also in improving ROM of frozen shoulder patients as compared to capsular stretching. Hence the finding of the current study is, AJM is more effective in PA Shoulder patients. To our knowledge this is the first study to compare the effectiveness of AJM and Three directional MCS in PA shoulder using standard tools. **Limitations:** The study had a small sample size and a short follow-up period. Additionally, pain was assessed using a subjective tool. **Recommendations:** A similar study can be conducted with a larger sample size to strengthen the results. Long-term effectiveness of AJM should be explored in future research. Further studies are needed to establish the effectiveness of AJM and to measure pain using objective tools.

7. CONCLUSION

Both Angular joint mobilization and Three directional manual capsular stretching are effective treatment techniques so both can be preferred for treatment of Periarthritis shoulder. Further Angular joint mobilization is more effective in reducing pain, increasing range of motion and improving function in patients with periarthritis shoulder.

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