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RESEARCH ARTICLE

EFFECT OF END RANGE MOBILIZATION AND MOBILIZATION WITH MOVEMENT IN PATIENTS WITH ADHESIVE CAPSULITIS

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ABSTRACT

Introduction: Adhesive capsulitis is a condition of uncertain aetiology characterized by significant restriction of both active and passive shoulder motion that occurs in the absence of another known intrinsic shoulder disorder. Maitland's concepts involve the application of passive and accessory oscillatory movements to spinal and peripheral joints Principle of mulligan's mobilization with movement is, the limited painful physiological movement is performed actively while the therapist applies a sustained accessory glide at right angle or parallel to a joint. Both the treatment can be valuable additions to existing treatment. **Aims & Objectives:** So the present study is performed to compare the effectiveness of end range mobilization and mobilization with movement on pain, range of motion and function in patients with adhesive capsulitis. **Materials & Methodology:** Pilot study was done for the sample size calculation. 33 participants were randomly divided into 3 groups with incidental sampling with random allocation: group A- end range mobilization and group B- mobilization with movement and group C- control. Ethics approval was taken from the Institutional review board of S.B.B. College of physiotherapy. Participants in each group were treated for a period of 1 week, for 6 days a week, once daily. Subjects in all three groups received hot moist pack and other therapeutic exercises. Outcome measures were VAS, SPADI, ROM; they were taken at baseline and after 1 week of treatment. **Results:** Results showed a significant improvement in all the outcome measures in all the three groups as compared to baseline. In addition, end range mobilization and mobilization with movement was found to be significantly equally effective than compared to control group for pain, ROM and SPADI. So effect size was calculated which shows that the effect size of group A was significantly more than that of group B & C. **Conclusion:** End range mobilization was found to be more effective than mobilization with movement in improving pain, range of motion and function than other two groups.

INTRODUCTION

Adhesive capsulitis is a condition of uncertain etiology characterized by a progressive loss of both active and passive shoulder motion[1-3]. Clinical syndromes include pain, limited range of motion (rom) and muscle weakness from disuse[1,2,4]. Annual incidence of adhesive capsulitis are 2-4% in general population[2,5,,6,] and upto 30% in people with diabetes[7.8]. Adhesive capsulitis is also reported to be more in women, especially between ages of 40 to 60 years[5,6,9]. Capsular extensibility is decreased in patients & the axillary recess becomes adherent, and the flexibility of the biceps tendon in its sheath is reduced. As a result, the external rotation of the humeral head to pass under the acromion during abduction is severely restricted. It's a condition which can be treated by wide variety of manual therapy, electro therapy, anti inflammatory drugs, intra articular corticosteroid drugs, manipulation under anesthesia, arthroscopic release and repair etc.

Adhesive capsulitis can be classified as (1) primary, which can be insidious or idiopathic and (2) secondary, which is generally due to trauma or subsequent immobilization[10] .those with primary adhesive capsulitis generally have a very gradual onset and progression of symptoms, these symptoms may progress so slowly that the patient does not even seek medical attention until rom and pain severely limit their daily activities.

Clinical phases: three distinct stages [11]. 1st stage is freezing phase or painful stage. This stage lasts for 3 to 9 months. 2nd satge is frozen or transitional stage. During this stage shoulder pain does not worsen more. Because of pain at end rom, use of the arm may be limited causing muscular disuse. The frozen stage lasts anywhere 4 to 12 months[12]. The common capsular

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pattern of limitation has been described as diminishing motions with external shoulder rotation, followed closely by shoulder flexion, and internal rotation. The 3rd stage begins when rom begins to improve. This 3rd stage is termed the thawing stage. This stage lasts anywhere from 12 to 42 months and is defined by a gradual return of shoulder mobility.

Manual therapy includes various joint mobilization and soft tissue manipulation techniques for adhesive capsulitis. In that peripheral joint mobilization is very widely used. Hence the present study was undertaken with an intention to find out effect of end range mobilization and mobilization with movement on shoulder range of motion and pain in patients with adhesive capsulitis.

MATERIALS AND METHODS

This quasi experimental study was carried out at s.b.b. college of physiotherapy. Materials used were goniometer for ROM, ruler for 10 cm vas scale, pen, paper, mobilization belt. Hot moist packs were given for 15 mins to the involved shoulder. Sample size was calculated by a pilot study done on 5 patients in each group at power of 80% and level of significance was kept at 5%. VAS for pain rating was selected for sample size estimation. SD was 0.9939 and effect size was 1.3. So sample size was calculated to be 9 in each group total 27. With assumption of 20% drop out the sample size was 11 in each group. With use of power analysis 33 subjects (both males and females) were selected with a medical diagnosis of adhesive capsulitis and incidental sampling with random allocation method was used for three group distribution. Group "A" was treated with end range mobilization and group "B" was treated with mobilization with movement and group "C" was given hot moist pack and exercises. Pre and post treatment VAS, ROM and SPADI was taken.

Patients having unilateral involvement from more than 3 months, age between 40-60 years with loss of ≥50% ROM of shoulder were included. Patients having history of trauma, rheumatoid arthritis, bilateral shoulder involvement, signs of cervical radiculopathy were excluded from the study. Written consent was taken from all participants to undergo treatment. Objective assessment of the involved shoulder for tenderness, pain and available range of motion was taken. Pain intensity was assessed on vas.

Common treatment given to the all three groups: 15 mins hot moist pack and active assisted wand, ladder, pulley, shoulder wheel exercises were given with strengthening exercise of shoulder muscles and pendular exercises.

In group "A": patients were taken to his/her maximum available ROM and then end range mobilization was given. Mobilization was of grade 3 or 4 as patients' tolerance &10 to 15 repetitions of the mobilization were given[13].

In group "B": mobilization with movement was given to improve flexion, abduction, internal and external rotation in postero-lateral-inferior direction in sitting position, inferior gliding force in supine lying and distraction and inferior gliding force in sitting. Three sets of 10 repetitions was applied with rest interval of 30s between each set.

In group "C": hot moist packs and other assistive exercises were given.

RESULT

Statistical analysis: data was assessed using spss16.
Before applying statistical tests, data was screened for normal distribution. Difference vas, difference flexion rom, difference abduction rom, difference internal rotation rom, difference disability spadi showed normal distribution and difference extension rom, difference external rotation rom, difference pain spadi, difference total spadi didn't showed normal distribution pattern.

For difference in pain spadi and difference total spadi square root data transformation was applied. For difference in external rotation log10 data transformation was applied.

All the outcome measures were analysed at baseline and after 1 week of treatment using appropriate statistical test. Level of significant was kept at 5%.

Changes in outcome measures were analysed within group as well as between groups.

On observing the effect sizes among the three groups(a, b, c) for VAS, ROM & SPADI it can be concluded that the effect size of group a was significantly more than that of group b & c.

DISCUSSION

The present study was done to see the individual effect and to compare the effectiveness of end range mobilization and mobilization with movement on pain, range of motion and function in patients with adhesive capsulitis.

Result of the present study showed positive findings with statistically significant improvement in pain, range of motion and shoulder function at 1 week as compared to baseline in all 3 groups.

Statistically significant reduction in the vas scores for all the three groups with $p<0.001$ were found compared to the baseline data.

For within group analysis group a ($t=5.174$, $p<0.001$) showed statistically significant difference in the vas score.

This result is consistent with the findings of abhay kumar *et al* in 2012, they conducted a randomized trial on 40 subjects with idiopathic adhesive capsulitis where maitland mobilization was compared with a common supervised exercise program. Results showed that both the groups showed effective reduction in the vas scores where the differences in the scores however were found in favor of the maitland group.

The pain relief through the maitland mobilization can be explained through the fact that oscillatory mobilization techniques of the kind advocated by maitland can reduce pain by stimulating natural pain killing endorphins but unless the cause of pain is removed, the relief will be temporary. In case of muscle spasm, however, oscillatory mobilization techniques may break the pain cycle and spasm being one of the most common causes of pain in adhesive capsulitis can be influenced by this mobilization technique.[14]

For within group analysis group b ($t=9.134$, $p<0.001$) showed statistically significant difference in the vas score.

The results of the present study are consistent with the findings of the study done by pamela teys *et al* who studied the effects of mulligan mwm techniques on shoulder rom in the plane of the scapula and pressure pain threshold (ppt) in participants with anterior shoulder pain. Clinically meaningful improvements were found in both rom and ppt that occurred immediately after post treatment. Based on the results of the study it indicates that shoulder mwm may be useful manual therapy technique with a painful limitation of shoulder elevation.[15]

Pain is likely to induce muscle spasm detracting movement from the treatment plane thereby preventing realignment.[16]

For within group analysis group c ($t=5.169$, $p<0.001$) showed statistically significant difference in the vas score.

All three groups received codman's exercises. Weight was not used if pain was severe. This technique uses the effects of gravity to distract the humerus from the glenoid fossa. They help to relieve pain through gentle traction and oscillation and provide movement of the synovial fluid. It also relives pain through the neurophysiological and mechanical effect.[17] which might be effective to relieve pain in group c.

Modalities are suggested to influence pain and muscle relaxation, therefore they might enhance the effect of exercises and manual techniques. Hot moist packs that were used common to all 3 groups are superficial heating modalities that transfer energy to the patient's skin through conduction and they are most often used to reduce pain and superficial muscle spasm, and to improve tissue extensibility[18]. The reduction of pain occurs via the release of thermal energy that stimulates specific thermo receptors in the area applied causing counter irritation and reduction in pain. Evidence also suggests that application of moist heat on the shoulder is effective in improving the range for a non affected shoulder.[19]

Significant reduction in the vas scores for all the three groups were seen, for multiple comparisons post hoc bonferonni test was used, which showed statistically significant difference between group a & c ($p<0.001$), and b & c ($p<0.001$) and there was no significant difference found between group a & b ($p=1.000$).

For the present study both end range mobilization and mwm were found to be equally effective in reducing the pain. End range mobilization and mwm both work on the pain gate mechanism which may be possible cause for the equal pain reduction effect in both the groups compared to control group. End range mobilization techniques reduce pain due to neurophysiologic effect on stimulation of peripheral mechanoreceptors and the inhibition of nociceptors. The activation of apical spinal neurons as a result as peripheral mechanoreceptors by the joint mobilization produces presynaptic inhibition of nociceptive afferent activity[20]. And for mwm which provides a passive pain free end range corrective joint glide with an active movement. This combination of the glide by the therapist and the active movement performed by the patient may be responsible for the rapid recovery of pain free movement.

Statistically significant improvement in the rom scores for all the three groups with $p<0.001$ were found compared to the baseline data.

For within group analysis of group- a, all rom showed statistically significant difference.

The results of the present study are consistent with the findings obtained in the study conducted by *wadsworth et al (1986)* demonstrated that, passive oscillatory movements are effective to reduce pain and increase in all the motions significantly in the frozen shoulder patients because of neuromodulation effect on the mechanoreceptors within the joints *(barak, 1985).* Many authors and clinicians advocated joint mobilization for pain reduction and improved rom *(vermeulen et al, 2000; vermeulen et al, 2006). Johnson et al (2007)* who found significant improvement in external rotation motion in patients with frozen shoulder. These findings support the results obtained in the present study. *Vermeulen et al (2000)* demonstrated that, with end range mobilization techniques (emts) there is increases in joint capacity and glenohumeral mobility after 3 months of treatment. He reported significant improvement in active and passive motion, pain and joint volume & the results coincide with the present study.[21]There may be structural changes of the shortened periarticular tissues. The tendency of the joint capacity to regain normal values has been described by mao *et al*, who found an increase in joint capacity in the shoulders of seven patients with frozen shoulders after treatment. Mao *et al* showed reappearance or enlargement of the axillary recess and smoother capsular margins in 11 of 12 patients with frozen shoulder. [21]

For within group analysis group-b, all rom showed statistically significant difference. Mulligan's mobilization with movement provides a passive pain free end range corrective joint glide with an active movement. This combination of the glide by the therapist and the active movement performed by the patient may be responsible for the rapid recovery of pain free movement. Mulligan proposed that a minor positional fault of the joint may occur following an injury or strain resulting in movement restriction or pain. It can be hypothesized that the mulligan's mwm has effect in reducing pain due to the fact that the techniques are always applied in a pain free direction, active movements and are described as correcting joint tracking from a positional fault.[22]

For within group analysis group-c, all rom showed statistically significant difference.

In group c, noticeable improvement may be due to beneficial effect of supervised exercise protocol. Many studies have claimed that exercise program is the most effective treatment for shoulder adhesive capsulitis. Exercises within the pain free range of motion stimulates mechanoreceptors and decreases pain. Exercises within pain free range also move the synovial fluid, thus decrease inflammation and decreased pain. [23,24]

Significant improvement in the rom scores for all the three groups were seen, for multiple comparisons post hoc bonferonni test was used, which showed statistically significant difference for all rom between group a & c, group b & c and there was no significant difference found between group a&b for all rom.

Demographic details of all three groups.

	Group a	Group b	Group c	F value	P value
Mean age	48.91±1.29	52.27±5.81	49.27±6.35	1.21	0.31
Duration of symptoms	5.22±2.06	4.86±1.05	4.95±1.12	0.17	0.83
Female	4	5	4	-	-
Male	7	6	7	-	-

For within group analysis group a (t=5.85, p<0.001) showed statistically significant difference in the spadi score.

This result correlates with previous studies[25, 26] conducted by vermeulen hm and j. F. Chen, which studied the effects of maitland's erm and exercises on subjects of adhesive capsulitis and found that besides pain and rom, function also improved. Rationale behind improvement in functional capacity in group a might be due to ease in pain and increased range of motion, consequently lessened suffering in daily activities, pain with specific tasks, and difficulty in moving arm and lifting actions. When patient's pain decreased, it revealed a reduction in spadi scores.

For within group analysis group b (t=10.94, p<0.001) showed statistically significant difference in the spadi score.

Vermeulen hm[25] studied effect of mulligan's mobilization in patients with frozen shoulder and which shows improved in mobility and functional ability. The mechnism for improvement in the spadi scores were due to impovement in rom and reduction in pain which will lead to improvement in function.

Paired t Test for Within Group Analysis

	GROUP A				GROUP B				GROUP C			
	PRE	POST	t value	p value	PRE	POST	t value	p value	PRE	POST	t value	p value
VAS	3.75±1.58	1.83±1.16	5.17	<0.001	3.49±1.48	1.66±1.02	9.13	<0.001	4.5±1.70	4.10±1.79	5.16	<0.001
ER	31.73±18.1	45.64±20	5.36	<0.001	39.55±17.3	48.55±16.6	7.37	<0.001	18.45±5.35	21.64±5.87	7.17	<0.001
ABD	82.09±10.9	95.45±12.4	5.12	<0.001	76±17.28	88.64±15.9	8.36	<0.001	73.55±14.08	76.09±14.5	7.01	<0.001
FLEX	109.09±16	120.5±21.1	5.24	<0.001	110.4±20.7	118.3±20.6	9.33	<0.001	91.91±20.06	94.18±20.5	5.59	<0.001
IR	27.09±8.58	36.55±11.7	4.81	<0.001	41±16.68	50.18±14.9	8.87	<0.001	27.82±13.24	30.09±13.6	6.82	<0.001
EXT	33.45±5.42	39.82±6.09	4.91	<0.001	32.36±6	38.09±6.26	6.12	<0.001	29.09±2.80	31.91±2.66	5.62	<0.001
SPADI	59.43±16.7	31.39±15.7	5.85	<0.001	47.68±15.9	27.54±12.3	10.94	<0.001	56.07±22.72	51.31±23.2	8.07	<0.001

Between Group Comparison With Post Hoc Bonferonni Analysis

DIFFERENCE IN	GROUP A	GROUP B	GROUP C	F VALUE	p VALUE
VAS	1.31±0.44	1.31±0.31	0.59±0.20	16.623	<0.001
ER	3.55±1.17	2.92±0.68	1.74±0.40	13.908	<0.001
ABD	3.53±0.98	3.49±0.66	1.32±0.93	23.19	<0.001
FLEX	3.25±0.97	2.76±0.56	1.35±0.70	18.4	<0.001
IR	2.92±1.00	2.98±0.55	1.47±0.34	16.924	<0.001
SPADI	5.07±1.56	4.42±0.78	2.14±0.42	24.05	<0.001

Effect Size Calculation

	GROUP A	GROUP B	GROUP C
VAS	-1.65	-1.79	-0.22
ER	0.69	0.53	0.54
ABD	1.07	0.79	0.17
FLEX	0.54	0.38	0.11
IR	0.80	0.61	0.16
SPADI	-1.78	-1.63	-0.20

In the present study result shows that both end range mobilization and mwm are equally effective in improving the rom. Passive oscillatory movements performed in the end range mobilization found to reduce pain and thus improve in rom. With mwm there will be correction of the positional fault which will result in pain free rom and improvement in rom. Thus both were found equally effective in improving rom, compared to control group.

Statistically significant reduction in the spadi scores for all the three groups with p<0.001 were found compared to the baseline data.

For within group analysis group c (t=8.07, p<0.001) showed statistically significant difference in the spadi score.

This result correlates with previous studies[25, 26] conducted by vermeulen hm and j. F. Chen, which studied the effects of maitland's erm and exercises on subjects of adhesive capsulitis and found that besides pain and rom, function also improved in both the groups. Rationale behind improvement in functional capacity in group c might be due to ease in pain and increased range of motion, consequently lessened suffering in daily activities, pain with specific tasks, and difficulty in moving arm and lifting actions. When patient's pain decreased, it revealed a reduction in spadi scores.

For multiple comparisons post hoc bonferonni test was used, statistically significant difference was found between group a & c (p<0.001) b & c (p<0.001) and there was no significant difference was found between group a & b (p=0.453).

This result is supported with the study done by ankit shrivastava which shows there was a significant difference in the spadi score at follow-up in maitland and mulligan groups. Whereas, between groups comparison shows that the difference was not significant between the groups. This signifies that both of the above mentioned mobilization techniques are equally effective in improving the functional outcome in the patients.[27] Improvement in spadi scores in both end range mobilization and mwm groups were found due to reduction in pain and improvement in rom which lead to improve the function of patient's daily activity.

Limitations

Blinding was not done
Long term follow up was not taken
Short duration of treatment protocol

Future recommendations

Studies comparing different grades of mobilization can be done.
Studies comparing end range mobilization or mwm with other longer duration treatment protocol can be done.

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