

To Study the Effectiveness of Laser Therapy and G.D Maitland Mobilization in Adhesive Capsulitis Among 40-50 Years Age Group Male Patients

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Abstract- Background: The study focused to make a comparative evaluation regarding the efficacy of laser therapy treatment with that of the Maitland mobilization technique in patients with adhesive capsulitis. **Objective:** Study to show the effectiveness of laser therapy and G.D Maitland mobilization in adhesive capsulitis. **Methods:** In this randomized controlled study, total subject 30 participants were equally divided using random method in to two different treatment groups with each group having 15 patients each in each of the group namely GD Maitland Mobilization and the LASER therapy group. All the subjects were treated for 3 sessions per week for six weeks (total 18 sessions). The variable of the study include assessments of pain severity on Visual Analogue Scale (VAS), shoulder active ROM (flexion, extension, abduction), associated disability SPADI scores for pain and disability scales. The variable score were taken in the beginning of the study (day 0) and after 30 days and 90 days for both the group. Goniometric assessment of active ranges of shoulder movements were made for the range documentation of the study. Data of 30 subjects (only men) enrolled subjects were used for analysis. **Results:** In the study there are improvement in all shoulder parameters after treatment and in the follow up period compared to before treatment in both groups. **Conclusion:** though both treatment are effective in reducing the symptoms associated with adhesive capsulitis, the study concludes that G.D Maitland is more effective than Laser therapy at the 30 days documentation. **Index Terms :** adhesive capsulities, laser therapy, maitland, rom, vas, spadi

I. INTRODUCTION

Adhesive capsulitis (AC) is a painful and disabling disorder, which caused restricted motion and chronic pain of shoulder [1]. Shoulder adhesive capsulitis is a condition mainly characterized by a decreased range of motion (ROM), with a lifelong prevalence of 2–5 % [2]. Adhesive capsulitis of the shoulder (AC), also known as frozen shoulder, is an inflammatory and fibrosing condition of the shoulder characterized by progressive pain and decreased range of motion of the glenohumeral joint [3]. Adhesive capsulitis is considered to be a self-limiting condition of unknown etiology characterized by painful and limited active and passive glenohumeral range of motion of $\geq 25\%$ in at least two directions most notably shoulder abduction and external rotation [4]. Frozen shoulder is a common condition, yet its treatment remains challenging.

Siegel et al (1999) defined adhesive capsulitis as a syndrome as idiopathic painful restriction of shoulder movement that results in global restriction of the gleno humeral joint [5]. Frozen shoulder affects 2% to 5% of general population and the incidence is higher in females than in males [6]

Adhesive capsulitis can be classified as primary or secondary when it has unknown etiology or when it is secondary to any existing pathological / surgical event [7]. Common causes of secondary frozen shoulder include diabetes mellitus, cardiopulmonary condition, cervical disc, stroke, upper extremity fractures, neurological diseases, rotator cuff pathologies, biceps tendonitis, calcific tendonitis, AC joint arthritis etc. [8]. More prone population to develop adhesive capsulitis include women, elders, and individuals 40-65 year old, diabetic population. Synovial inflammation and capsular fibrosis are the central pathology of Adhesive Capsulitis (AC), which subsequently leads to formation of adhesion, capsular contracture and decreased joint capacity [9].

There are three overlapping but easily identified three phases of adhesive capsulitis namely: freezing, frozen and thawing stage. There is marked pain in the freezing stage followed by pain and stiffness in the frozen stage, pain decreases and stiffness improves in the thawing stage [10]. Conservative management is most recommended a most optimum form of the management of adhesive capsulitis. Usually anti-inflammatory medicines do help to reduce the extent of associated inflammation and help to reduce the pain but rarely it helps to regain the already lost movement.

Various intervention such as oral medications, corticosteroid injections, manipulation, and surgery are used. Yet the finding best optimal form of the conservative intervention remains an issue of continuously ongoing research. It has been discussed that the primary treatment for adhesive capsulitis should be based on physical therapy and anti-inflammatory measures [11]. Modalities, such as hot packs, can be applied before or during treatment. Moist heat used in conjunction with stretching can help to improve muscle extensibility and range of motion by reducing muscle viscosity and its relaxed [8]. In patients with high irritability, range of motion exercises performed with low intensity and a short duration can alter joint receptor input, reduce pain and decrease muscle guarding.

In Adhesive phase the focus of treatment should be shifted towards more aggressive stretching exercise in order to improve range of motion. The patient should performed low load, prolonged stretches in order to

produce plastic elongation of tissues and avoid high load, brief stretches which would produce high tensile resistance. During the second phase of treatment, movement with mobilization and end range mobilization have shown to be successful, according to a randomized multiple treatment trial by Yang et al (2007) [12]. Resolution Phase, treatment is primarily by increasing stretch frequency and duration, while maintaining the same intensity, as the patient is able to tolerate. The stretch can be held for longer periods, and the sessions per day can be increased. As the patients irritability level becomes low, more intense stretching and exercises using a device such as pulley may assist tissue remodeling.

Mobilizations may include the breakup of adhesions, realignment of collagen, or increased fibre glide when specific movements stress certain parts of the capsular tissue. High grade mobilization techniques (HGMT) have been shown as a important technique for improving range of motion in patients with adhesive capsulitis for at least three months.

In a study by Vermeulen et al, patients were given inferior, posterior and anterior glides as well as a distraction to the humeral head. These techniques were performed at greater elevation and abduction angles if glenohumeral joint range of motion increased during treatment. Patients who received HGMT the mobilization of Maitland grades III and IV according to the subject's tolerance with the intention of 'managing the stiffness'. Patients were allowed to report a dull ache as long as it did not alter the execution of the mobilizations as persist for more than four hours after treatment. However, patients who received low grade mobilization technique (LGMT) were given Maitland Grades I or II without the perception of pain [13].

Maitland's mobilization technique involves the application of passive and accessory oscillatory movements to spinal and vertebral joints to treat pain and stiffness (Gautametal, 2014). These movements are graded 1 to 5 depending on the condition of the patient. Stretching techniques are also prescribed in Maitland's technique to treat muscle spasm [14]. The HGMT appear to be more effective for increasing joint mobility and reducing disability. HGMT beneficial during later stages of adhesive capsulitis, while LGMT would provide stages.

Low energy laser therapy (LLLT) has recently been popularized in the treatment of various rheumatologic, neurologic and musculoskeletal disorders such as osteoarthritis, rheumatoid arthritis, fibromyalgia, carpal tunnel syndrome, rotator cuff tendinitis and chronic back pain syndromes. LLLT is believed to modulate neuronal activity in the tissue and have a pain relieving effect; however, the indication for LLLT in painful musculoskeletal system disorders is known for discussion and establish its reliability. Low-level laser therapy is strongly suggested for pain relief and moderately suggested for improving function but not recommended for improving ROM [15].

Hill et al (2011) concluded that SPADI has a bi-dimensional factor structure representing pain and disability, with adequate internal consistency and

construct validity for use in population studies of shoulder symptoms [16].

The objective of this paper is to establish the clinical result of efficacy of LLLT in the management of early phase of symptomatic adhesive capsulitis of the shoulder in elderly. Also effects of mobilization of (LGMT) and HGMT in improvement of pain, ROM and reducing limitation of shoulder mobility in adhesive capsulitis.

II. METHODOLOGY

This study was a randomized controlled in nature where aim of this systemic study was to assess the effects of Maitland mobilization and LLLT (low intensity LASER therapy) therapy along with supervised exercises in improving joint ROM; pain severity; and associated disability scores in subjects of grade I and II adhesive capsulitis patients who were referred by orthopaedic surgeon. This study protocol was approved by Monad University, Hapur, UP for PhD curriculum course. The study was conducted at Goodwill Hospital and J S Hospital Noida UP in department of physiotherapy.

A. Types of Participants

Thirty male participants 15 in each group A and B equally divided, with diagnosed case of unilateral grade I & II adhesive capsulitis; age group of 40-50 years of painful condition of at least 3 months; atleast 50% restriction in passive shoulder flexion, abduction, external rotation, extension of shoulder movement as compared with opposite side. Group A subjects were given hot pack; Maitland mobilization and conventional exercises were given along with home based exercise. The group B patients were given Laser therapy and supervised conventional exercises at department and followed by home exercise.

Pre-participation evaluation form consist of shoulder pain and disability index, age, height, weight, duration of symptoms, visual analogue scale (VAS) score for pain, active range of motion of flexion, extension, abduction, of shoulder joint; pain scores on SPADI pain 5 Questionnaire scale of 10 point each was graded and SPADI, disability score on 8 questionnaire scale on 10 point each is taken for evaluation.

Those patients were excluded from the study who exhibit following exclusion criteria: Previous history of manipulation under anesthesia of the affect shoulder; systemic arthritic conditions of shoulder (e.g. Rheumatoid arthritis, Osteoarthritis, damage of the glenohumeral cartilage, Hill Sachs lesion osteoporosis or malignancies in the shoulder region); history of fracture; neurological deficits affecting shoulder dysfunction in normal daily activities; pain or disorders of the cervical spine, elbow, wrist or hand; injection with corticosteroids in the affected shoulder in the preceding 6 weeks; any skin lesions/bruises around the shoulder; non-cooperative patients.

B. Group –A protocol for the Maitland mobilization group

The patients of Maitland mobilization group were given hot pack and G D Maitland mobilization Grade I & II with wall crawling and T-Pulley exercises thrice a week with

15-20 repetition per session for 6 weeks (18 treatment sessions).The reading were taken at 0 day,1 month,3 month(0,30 days,90 days).

Hot Pack:- Firstly the hot pack was given to shoulder joint in supine position to cover shoulder joint for 10 minutes.**Maitland mobilization:** - The Maitland mobilization treatment started with the inferior glide of humeral head with the aimed at improvement of the extensibility of the axillary recess and or enhancing the movement of shoulder joint in the direction of abduction. Both hands of therapist were held close to the humeral head to work with a short lever arm. Oscillatory movements in the caudal, lateral and anterior direction were used. To influence the posterior part of the joint capsule, the hand was placed on the anterior part of the shoulder, and applied force was in the posterior and lateral direction. The Maitland Grade I, II, III, IV was used to mobilize the shoulder joint depending on level of pain and limitation of joint ROM as per the conceptual framework of GD Maitland mobilization.

The therapist supported the affected arm and move the shoulder into the end range of elevation. The heel of the other hand pushed against the lateral border of the scapula in medial rotation to produce distraction within the glenohumeral joint.

The treatment was given thrice a week for 6 weeks 18 treatment session.

Conventional exercises for shoulder joint

Wall crawler- Patient was advised to perform this exercise at clinic as well as at home twice a day for three months at least 20 repetition per day morning and evening.

T-Pulley- Patient was advised to perform this exercise when comes for treatment session and home setting by selecting a rope to be hanged from the hook at home and sitting below the U sling to lift arm up and down 50 repetition per day morning and evening.

C. Protocol for the group B (laser therapy)

LASER Therapy

With the patient in lying supine on high end couch with position of ease and shoulder joint relaxed, the target marks were made on the skin on four different aspect of shoulder from anterior, lateral and posterior at the tender point on arc of shoulder joint suffering from adhesive capsulitis. Therapist stood on the head side of the couch to place probe of the LASER on the affected shoulder joint. Both therapist and the patient should wear protective goggle for eye safety.

Parameter of the LASER therapy: Laser with infrared beam (LASERMED 2200 make in Italy) was used with following parameters; Infrared Diode Laser- 905 nm (single probe); maximum power- 25 watt; Peak power value- 25 watt; Pulse Frequency- 5000 Hz; Total energy density- 1.50 J/cm². Contact method was used with appropriate frequency and position of beam is directly incident on the marked point at four different location on shoulder joint. Duration of LASER therapy was 3 min/session on each marked point; 3 session per week in total of 6 weeks (18 treatment Sessions)

Exercise Program for Group B

Codman Pendular Exercise started with 10-15 repetition. Patients was asked to bend forward, flexing the trunk to right angle. The knees were slightly flexed to avoid low

back discomfort. The body was supported by placing the other arm upon table or chair. The arm was then moved forward and backwards, side to side and circumductory manner with arm moving 10 times advice to perform daily twice.

Shoulder Wheel Exercise has advice to perform clockwise and anticlockwise flexion and extension and circumduction of 360 degree rotation on the shoulder wheel with axis of shoulder joint aligned while patient standing straight with affected arm resting on the wrist gripping the handle. Depending on the recovery of shoulder ROM graded exercises for 10, 20, 50 repetition gradually performed for 6 weeks.

D. Home Exercises

All active ROM of shoulder flexion,extension,abduction,adduction,external rotation and internal rotation.Isometric shoulder exercise against the wall with pillow between the arm and wall with active force against the wall.Arm movement with crossed hand held together while standing moving crossed hand above the head and bringing it down gradually 15 to 30 times daily twice at home.

The data in respect to the variables of the study were recorded at baseline; at interval of 1 month; and at interval of 3 months from baseline. The readings were taken and evaluation done on VAS, SPADI and ROM measurement of shoulder joint affected from adhesive capsulitis.

E. Ethical clearance

The methodology of the study was approved by the research committee of the Monad University, Uttar Pradesh, India. The purpose and details of the study were explained to the study subjects and assurance was given regarding confidentiality of the participant's identity related data.

III. RESULTS

Table I. Comparison of demographic variables of groups using independent t-test

Demographic variables	Maitland mobilization techniques (n=15)	LASER group (n=15)	Level of significance (P value)
Age (years)	45.40 ± 2.85	47.33 ± 3.48	0.107 ^{ns}
Weight (kg)	63.27 ± 3.94	63.07 ± 4.03	0.892 ^{ns}
Height (cm)	164.93± 3.70	165.27 ± 2.25	0.768 ^{ns}
Duration of symptoms (weeks)	7.67 ± 2.70	9.67 ± 2.49	0.064 ^{ns}

Unpaired t-test was used to compare the demographic variables at baseline which shows that at baseline there was no statistically significant difference between the demographic scores of both the groups. It means both groups were homogenous at baseline with respect to their demographic characteristics.

Table II. Baseline comparison of the baseline scores of dependent variables.

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Variables scores at baseline	Maitland mobilization techniques (n=15)	LASER group (n=15)	Level of significance (P value)
VAS 0	7.20±0.77	6.80±0.67	0.143
Flexion 0	40.53±6.68	45.53±8.53	0.852
Extension 0	23.53±4.99	21.33±5.96	0.282
Abduction 0	44.22±20.56	42.06±12.52	0.734
SPADI pain 0	32.93±2.15	32.67±2.16	0.737
SPADI disability 0	56.13±1.41	55.07±2.68	0.183

Keys: -VAS- visual analogue scale score at 0day; SPADI 0- should pain and disability score at baseline. Independent t-test based baseline comparison of variable scores at baseline. It shows that at baseline scores of the dependent variables, there was no statistically significant difference between both the groups.

Table III. Showing ANOVA scores and post-hoc analysis for comparison of each group on “0 versus 30 day”, “30 day versus 90 day” and “zero versus 90 day” comparison.

ANOVA comparison and subsequent post-hoc analysis shows that in both the groups at each data recording session there was statically significant improvement in the variables scores. Furthermore the Maitland groups had higher improvement that the improvement observed in the LASER treated group.

	Day	Mean ± SD	Comparison	Mean difference	P value	Remark
VAS MAITLAND GROUP	"ZERO DAY"	7.2000 ± 0.78	"zero day vs 30 day"	1.80	0.000	Maitland group shows higher VAS reduction
	"30 DAY"	5.4000±0.63	"30 day vs 90 day"	3.00	0.000	
	"90 DAY"	2.4000±0.98	"zero day vs 90 day"	4.83	0.000	
VAS LASER GROUP	"ZERO DAY"	6.80 ±0.68	"zero day vs 30 day"	1.53	0.000	
	"30 DAY"	5.27±0.88	"30 day vs 90 day"	2.07	0.000	
	"90 DAY"	3.20±0.94	"zero day vs 90 day"	3.60	0.000	
FLEXION MAITLAND GROUP	"ZERO DAY"	40.53±6.69	"zero day vs 30 day"	27.40	0.000	Maitland group shows higher improvement in flexion ROM
	"30 DAY"	68.93±11.38	"30 day vs 90 day"	29.93	0.000	
	"90 DAY"	98.89±5.58	"zero day vs 90 day"	58.33	0.000	
FLEXION LASER GROUP	"ZERO DAY"	45.53±8.52	"zero day vs 30 day"	23.87	0.000	
	"30 DAY"	69.40±9.23	"30 day vs 90 day"	18.00	0.000	
	"90 DAY"	87.40±9.17	"zero day vs 90 day"	41.87	0.000	
EXTENSION MAITLAND GROUP	"ZERO DAY"	23.53±5.01	"zero day vs 30 day"	11.47	0.000	Maitland group show higher improvement except "zero vs 30 day" comparison where laser shows marginally better improvement
	"30 DAY"	35.0±5.50	"30 day vs 90 day"	11.87	0.000	
	"90 DAY"	46.87±4.83	"zero day vs 90 day"	23.33	0.000	
EXTENSION LASER GROUP	"ZERO DAY"	21.33±5.94	"zero day vs 30 day"	8.00	0.002	
	"30 DAY"	29.33±5.37	"30 day vs 90 day"	12.47	0.000	
	"90 DAY"	41.80±6.48	"zero day vs 90 day"	20.46	0.000	
ABDUCTION	"ZERO	44.20±20.56	"zero day vs 30 day"	44.27	0.000	Maitland group

MAITLAND GROUP	DAY"					shows higher improved in abduction ROM		
	"30 DAY"	88.47±56.56		"30 day vs 90 day"	37.80		0.000	
	"90 DAY"	126.27±19.46		"zero day vs 90 day"	82.06		0.000	
ABDUCTION LASER GROUP	"ZERO DAY"	42.06±12.52		"zero day vs 30 day"	39.87		0.000	
	"30 DAY"	81.93±13.89		"30 day vs 90 day"	37.67		0.000	
	"90 DAY"	119.60±17.42		"zero day vs 90 day"	77.53		0.000	
SPADI PAIN MAITLAND GROUP	"ZERO DAY"	32.93±2.15		"zero day vs 30 day"	10.40		0.000	Maitland group has higher improvement
	"30 DAY"	22.53±2.17		"30 day vs 90 day"	10.53		0.000	
	"90 DAY"	12.00±1.56		"zero day vs 90 day"	20.93		0.000	
SPADI PAIN LASER GROUP	"ZERO DAY"	32.67±2.16		"zero day vs 30 day"	7.87	0.000		
	"30 DAY"	24.80±1.32		"30 day vs 90 day"	9.53	0.000		
	"90 DAY"	15.27±1.33		"zero day vs 90 day"	17.40	0.000		
SPADI DISABILITY MAITLAND GROUP	"ZERO DAY"	56.13±1.41		"zero day vs 30 day"	19.40	0.000	Maitland group has higher improvement	
	"30 DAY"	36.73±3.70		"30 day vs 90 day"	18.20	0.000		
	"90 DAY"	18.53±2.10		"zero day vs 90 day"	37.60	0.000		
SPADI DISABILITY LASER GROUP	"ZERO DAY"	55.06±2.68		"zero day vs 30 day"	13.73	0.000		
	"30 DAY"	41.33±1.76		"30 day vs 90 day"	16.33	0.000		
	"90 DAY"	25.00±2.20		"zero day vs 90 day"	30.07	0.000		

IV. DISCUSSION

The findings of this study demonstrated that Maitland's mobilization as well as Laser both successfully reduced the shoulder pain and associated disability; also both treatments caused significant improvement in shoulder function for people with adhesive capsulitis but the patient who received the Maitland mobilization responded more to treatment.

Levine & Kashyap (2007) in their study on 234 patients treated for idiopathic adhesive capsulitis, gave non-steroidal anti-inflammatory medications to all patients and about 52.4% received physical therapy without cortisone injection. They concluded that with supervised treatment, most patients with adhesive capsulitis experienced resolution with non-operative measures. Only a small percentage of patients eventually required operative treatment [17]. Thus in majority of patients the conservative treatments are preferred and sufficient treatment options for managing idiopathic adhesive capsulitis. The physiotherapy exercises bring positive improvement in majority of patients with adhesive capsulitis.

The observed improvements in pain and shoulder functions were comparable to similar previous studies.

Vemeulen et al compared high grade and low grade mobilization techniques in patients with adhesive capsulitis. One hundred subjects who had symptoms for more than 3 months and 50 % loss of passive range of motion were included and assessed at baseline as well as 3, 6 and 12 months post treatment. Primary outcome measures included the shoulder rating Questionnaire (SRQ), shoulder disability Questionnaire (SDQ), active and passive range of motion. Overall, both groups showed improvements at 12 months with the high grade mobilization group being slightly more effective at reducing disability and improving joint mobility [13].

Jewell et al also have demonstrated the beneficial effects of joint mobilization and exercise for patients with adhesive capsulitis [18].

Jurgel et al (2005) conducted study for assessing shoulder function and pain severity in patients with frozen shoulder before and after 4 week rehabilitation program of combined exercise with electrical therapy and massage. After 4 week rehabilitation program significant improvement in shoulder muscle isometric strength and endurance; and significant decrease in shoulder pain in patients with frozen shoulder was observed [19].

Yang et al (2007) had performed a multiple treatment trial using combinations of end range mobilization,

midrange mobilization, and mobilization with motion in patients with adhesive capsulitis. They found improved motion and function at 12 weeks with end range mobilization. It was concluded that end range mobilization was more effective than mid-range mobilization in increasing motion and functional mobility. In our current study also the progression towards end range mobilization was done as patients exhibited improved range of motion. Thus our study results are in concordance with the findings of the Yang et al [12].

Saunders et al (1995) suggested that low intensity LASER irradiation to the supraspinatus tendinitis produces better effect in reducing pain and tenderness. Laser penetrates upto 2mm to 40 mm and produces stimulation in the cellular activity and relieve pain, stimulates repair in tissues by increasing blood supply in the tissue and improve muscle force. In the laser irradiated group and placebo group, the tenderness at the supraspinatus decreases in the laser group than the placebo group [20]. Kiristi et al (2010) stated that low level laser reduces pain and tenderness in plantar fasciitis with average thickness of 2.9mm to 6.4mm in symptomatic patients. LLLT helps to accelerate wound healing, decreases pain, speedy recovery from musculoskeletal injury. They observed that improvement in laser group than placebo group, there is decrease in pain and tenderness when compared from baseline to post end treatment after 6 week in VAS Scale by 59% in laser irradiated and 29% in placebo group [21].

Therapeutic mechanisms of LASER therapy include: increased mitochondrial ATP and tissue oxygenation, increased levels of neuro transmitters implicated in pain modulation (such as serotonin). By this anti-inflammatory effects low level laser is used to decrease the inflammation in the knee joint and improve knee function ADL (activity of daily living) and strength of Quadriceps muscles when compared to placebo group [22]. Yashiro Musha, Takao Kaneko Toshio Shigemitsu et al said that low level laser therapy is effective in pain relief and improve range of motion of shoulder periarthritis and serum prostaglandin E2 (PGE2) level decreases and VAS Score for pain decreases [23].

In this current study the minimum duration of symptoms related to the pain and disability were of 3 months, therefore it is assumed that during this time period the capsule must have developed some adhesions which could be responsible for the restriction in the ranges of motion of shoulder joint.

In Maitland mobilization group there was significant improvement in all ranges of motion as compared to LASER treatment only. This increase in range of motion is to be linked to the stretching of the joint capsule and surrounding soft tissue during shoulder Maitland mobilization. Thus, Maitland mobilization are found as an effective treatment for Adhesive Capsulitis with significant reduction in pain and disability scores.

Limitation of study

No radiological assessment or tissue biopsy method was used to actually explain the tissue change resulting from the interventions given.

V. CONCLUSION

The findings of this study demonstrated that Maitland's mobilization as well as LASER both successfully reduced the shoulder pain and associated disability; also both treatments caused significant improvement in shoulder function for people with adhesive capsulitis but the patient who received the Maitland mobilization responded more to treatment.

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