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Research Article

A Comparative Study on Effectiveness of Combination of Maitland Mobilization plus IFT and Combination of IFT plus Shoulder Exercises in Patients with Adhesive Capsulitis

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Abstract: Adhesive capsulitis is characterized by severe joint pain, stiffness with progressive restriction of movement in all planes of shoulder joint. In the present study, purposively selected 60 patients with adhesive capsulitis aged 40-60 years from the Physiotherapy Center, Guru Nanak Dev University, Amritsar, participated in two intervention groups (for 6 weeks each), i.e. 30 subjects who received Maitland mobilization plus interferential therapy (IFT) and 30 subjects who were treated with IFT plus shoulder exercises. Outcome variables were shoulder abduction s. flexion, s. extension, s. external rotation, s. internal rotation, VAS, pain scale, disability and total SPADI. The results indicated significant improvement ($p<0.001$) in shoulder range of motion and decrement in VAS, disability and total SPADI in patients with adhesive capsulitis after 6-week intervention using both Maitland mobilization plus IFT and IFT plus shoulder exercises, though the combination of IFT plus shoulder exercises showed significantly better improvement than Maitland plus IFT.

Keywords: adhesive capsulitis, Maitland mobilization, interferential therapy, shoulder exercises

INTRODUCTION

Adhesive capsulitis is a fast growing pathology which affects the middle-aged population. It is characterized by severe joint pain, stiffness with progressive restriction of movement in all planes of shoulder joint (Jewell *et al.*, 2009). It occurs from the contraction of the glenohumeral joint capsule and adherence to the humeral head (Ewald, 2014). Adhesive capsulitis affects the normal function of shoulder joint. The patients frequently have difficulty in dressing, grooming and performing overhead reaching activities for a period of several months or several years (Neviaser, 1987; Reeves, 1975). It adversely affects the entire upper extremity. The most common limitations in range of motion of shoulder joint are flexion, abduction and external rotation. It affects upto 3% to 5% of general population and upto 20% diabetic patients (Manske *et al.*, 2010), most commonly in type-2 diabetes mellitus (Vermeulen, 2006).

The etiology of adhesive capsulitis is not clear; possibly it involves non-specific chronic inflammatory reaction of sub-synovial tissue which results in capsular and synovial thickening. Approximately, 70% patients of adhesive capsulitis were women (Labbe, 2010). Pain and stiffness in the deltoid region are common symptoms of patients with adhesive capsulitis. When pain is increased during movement, it leads to limit daily living activities. Lying on the same side shoulder also causes problems with sleeping (Jayson, 1981; Bland *et al.*, 1977). Females and type-2 diabetes mellitus are commonly affected (Jewell *et al.*, 2009; Ewald, 2014; Vermeulan *et al.*, 2006). Secondary adhesive capsulitis is more common than primary adhesive capsulitis. Patients in the acute phase complained of more pain than movement restriction where as chronic patients had more restriction.

The traditional principles of treatment of adhesive capsulitis are to relieve pain, increase range of motion and to restore function. The treatment of adhesive capsulitis by means of physiotherapy consists of different modalities like therapeutic ultrasound (Dogr*et al.*, 2007), TENS (Dewan *et al.*, 2011), IFT (Cheing *et al.*, 2008; Panchal and Eapen, 2015), shoulder exercises (Diereks *et al.*, 2007; Carette *et al.*, 2003), Maitland mobilization (Phukon *et al.*, 2017; Kumar *et al.*, 2012) and others. The combinations of different modalities are also being tested for better

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efficacy in treatment protocol. The present study was planned to compare the effectiveness of Maitland mobilization plus IFT and IFT plus shoulder exercises to increase range of motion and decrease pain and disability in patients with adhesive capsulitis.

MATERIALS AND METHODS

Participants

The present study was comprised of purposively selected 60 patients (39 females and 21 males) with adhesive capsulitis aged 40-60 years from the Physiotherapy Center, Guru Nanak Dev University, Amritsar. The subjects were the employees of the university those who came to the Physiotherapy Center for treatment. The subjects were then randomly allocated into two groups for intervention. Group-A consisted of 30 subjects who received Maitland mobilization plus interferential therapy (IFT) for 6 consecutive weeks (alternate days) and Group-B comprised of 30 subjects who were treated with IFT plus shoulder exercises for 6 consecutive weeks (alternate days). The Age of the subjects was estimated from their date of birth. A written consent was obtained from the subjects. The study was approved by the Institutional Ethical Committee (IEC).

Maitland Mobilization

Maitland mobilization was given as per Maitland (1983) on alternate days that were 3 times in a week for 6 consecutive weeks. Glenohumeral caudal glide was given to improve abduction, Glenohumeral anterior glide was applied to improve shoulder external rotation and extension. Glenohumeral posterior glide was given to improve shoulder flexion and internal rotation.

Interferential Therapy (IFT)

IFT was used to decrease the pain. In this, electrodes were placed in two pairs i.e. quadripolar technique was used. Each pair was placed diagonally opposite to one another in such a way that it produced maximum effect on desired area. IFT was used with a sweep frequency of 80-110 Hz. for 10 minutes.

Shoulder Exercises

In this study, shoulder exercises were given which included pendulum exercises (Codman's exercise). Pendulum exercises included pendulum side to side, pendulum forward-backward and pendulum circular. Stretching exercises included cross body stretch, finger walk and towel stretch. Strengthening exercises included external and internal rotation exercises using theraband. Pulley exercises and shoulder wheel were also included. Duration of exercise program was 3 days per week for 6 consecutive weeks, repetitions - 10 times, sets - 3.

OUTCOME MEASURES

Shoulder Abduction (SAB)

The patient was asked to lie supine with shoulder in lateral rotation and 0 degree of flexion and extension with palms facing interiorly. The fulcrum of the goniometer was placed on the anterior aspect of the acromion process. The proximal arm of the goniometer was aligned parallel to the midline of the anterior aspect of the sternum and the distal arm, that was moving arm, was aligned with the anterior midline of the humerus. Depending on the amount of abduction and lateral rotation that occurred, the medial epicondyle was a helpful anatomical landmark for aligning the distal arm of the goniometer. The patient was asked to move the arm into abduction and the ROM was recorded on the goniometer in degrees.

Shoulder Flexion (SFL)

The patient was asked to lie supine. The shoulder was positioned in 0 degrees of abduction, adduction and rotation. Fulcrum of the goniometer was placed over the lateral aspect of the greater tubercle. The proximal arm was aligned parallel to the midaxillary line of thorax and the distal arm was aligned with lateral midline of the humerus. Depending on the amount of flexion and medial rotation, the lateral epicondyle of the humerus was a helpful anatomical landmark for aligning the distal arm of the goniometer. The patient was asked to move the arm in flexion and the ROM was recorded on the goniometer in degrees.

Shoulder Extension (SEXT)

The patient was asked to lie in prone, with the face turned away from the shoulder being tested. The patient was told to extend the shoulder by lifting the humerus off examining table. The therapist maintained the extremity in neutral abduction and adduction. Fulcrum of the goniometer was placed over the lateral aspect of the greater tubercle. The proximal arm was aligned parallel to the midaxillary line of the thorax and distal arm was aligned with the lateral midline of the humerus, using the lateral epicondyle of the humerus as anatomical landmark. Goniometer was aligned at the end of the ROM with the shoulder in extension and the ROM was recorded on the goniometer in degrees.

Shoulder External Rotation (SEXTR)

The patient was asked to lie in supine with the arm at 90 degrees of shoulder abduction. Distal end of the humerus was stabilized to keep the shoulder in 90 degrees of abduction. The shoulder was laterally rotated by moving the forearm posteriorly to bring the dosrsal surface of the palm of the hand towards the floor. The shoulder was maintained at 90 degrees of abduction and elbow was maintained at 90 degrees of flexion during this motion. Fulcrum of the goniometer was placed over the olecranon process. The proximal arm of the goniometer was aligned parallel to the floor and the distal arm was aligned with ulna, by using the olecranon process and ulnar styloid for reference. Goniometer was aligned at the end of the lateral rotation and the ROM was recorded on the goniometer in degrees.

Shoulder Internal Rotation (AINTR)

The patient was asked to lie in supine position with 90 degrees of shoulder abduction. A pad was placed under the humerus so that the humerus leveled with the acromion process. Distal end of the humerus was stabilized to keep the shoulder at 90 degrees of abduction. The shoulder was medially rotated by moving the forearm anteriorly, so that palm faces towards the floor. Fulcrum of the goniometer was placed over the olecranon process. The proximal arm of the goniometer was aligned perpendicular with the floor and the distal arm was aligned with ulna. Olecranon process and ulnar styloid was used for anatomical reference. The goniometer was aligned at the end of the medial rotation and the ROM was recorded on goniometer in degrees.

Measurement of Visual Analogue Scale (VAS)

The Visual Analogue Scale (VAS) was used to measure the pain of 24 hours as instructed by Bijur *et al.* (2001). It is a validated method used widely for pain measurement.

Pain Scale (PSCL), Disability (DIS) and Shoulder Pain and Disability Index (SPADI)

PSCL, DIS and SPADI was a patient completed questionnaire with 13 items assessing pain level and extend of difficulty with ADL`s requiring the use of upper extremities (Roach *et al.*, 1991).

The pain subscale as 5 items and disability subscale had 8 items.

Statistical Analysis

Data was analysed using SPSS (Statistical Package for Social Science) version 20.0. Independent t-test was applied for all the variables between the patients treated with Maitlamd mobilization plus IFT and IFT plus exercises and for within group comparisons. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 showed the descriptive statistics of different variables in patients with adhesive capsulitis treated with Maitland plus IFT. The post-intervention patients had higher mean values in SAB (75.33°), SFL (103.50°), SEXT (42.33^0), SEXTR (32.50°), SINTR (49.50°) and lesser mean values in VAS (6.93), PSCL (73.40%), DIS (71.20%), TSPADI (72.44%) than the pre-intervention patient counterparts (66.17°, 92.83°, 34.50°, 30.53°, 33.50°, 8.10, 84.53%, 83.19% and 84.13% respectively). However, significant differences (p<0.031-0.001) were noted in SAB (t=2.213), SFL (t=2.469), SEXT (t=3.771), SEXTR (t=3.481), SINTR (t=6.224), PSCL (t=5.819), DIS (t=7.348) and TSPADI (t=7.18) between them.

The descriptive statistics of different variables in pre- and post-intervention patients with adhesive capsulitis treated with IFT plus shoulder exercises were shown in Table 2.. The post-intervention patients had higher mean values in SAB (93.66°), SFL (115.56°), SEXT (47.66°), SEXTR (36.50°), SINTR (55.16°), VAS (7.79), and lesser mean values in PSCL (80.0%), DIS (77.77%) and TSPADI (78.53%) than their pre-intervention patient counterparts (80.93°, 102.70°, 39.33°, 29.83°, 44.33°, 7.97, 83.66%, 81.78% and 82.99% respectively). However significant differences (p<0.029-0.001) were noted in SAB (t=2.318), SFL (t=3.144), SEXT (t=3.875), SEXTR (t=2.586), SINTR (t=3.117), DIS (t=2.241) and TSPADI (t=2.395) between them.

Table 1. Descriptive statistics of different variables in pre- and post-intervention patients with adhesive capsulitis treated with Maitland and IFT

Variables	Pre-intervention patients with Maitland plus IFT		Post-intervention patients with Maitland plus IFT		t-value	p-value
	Mean	SD	Mean	SD		
SAB (degree)	66.17	16.70	75.33	15.36	2.213	**<0.031**
SFL (degree)	92.83	16.19	103.50	17.33	2.469	**<0.017**
SEXT (degree)	34.50	9.13	42.33	6.79	3.771	**< 0.001**
SEXTR (degree)	30.53	22.26	32.50	14.06	3.481	**<0.001**
SINTR (degree)	33.50	18.81	49.50	16.73	6.224	**<0.001**
VAS	8.10	0.80	6.93	0.64	0.409	0.684
PSCL (%)	84.53	8.17	73.40	6.56	5.819	**<0.001**
DIS (%)	83.19	7.15	71.20	5.37	7.348	**<0.001**
TSPADI (%)	84.13	6.58	72.44	5.42	7.18	**<0.001**

SAB = shoulder abduction, SFL=shoulder flexion, SEXT=shoulder extension, SEXTR= shoulder external rotation, SINTR=shoulder internal rotation, VAS=visual analogue scale,
PSCL=pain scale, DIS=disability, TSPADI=total SPADI.

Table 3 showed the descriptive statistics of different variables in post-intervention patients with adhesive capsulitis treated with Maitland plus IFT and IFT plus shoulder exercises. The patients treated with IFT plus shoulder exercises had higher mean values in SAB (44.33^0) SFL (93.66°), SEXT (115.56°), SEXTR

(47.66°), SINTR (36.50°), VAS (7.96), PSCL (80.00%), DIS (77.76%) and TSPADI (78.53). than the patients treated with Maitlant plus IFT (33.50^0, 75.33°, 103.50°, 42.33°, 32.50°, 6.93, 73.40, 71.20% and 72.43% respectively). However significant differences (p<0.021-0.001) were noted in SAB (t=2.531), SFL (t=3.782), SEXT (t=3.803), SEXTR (t=2.838), SINTR (t=2.169), PSCL (t=3.161), DIS (t=3.776) and TSPADI (t=3.439) between them.

Table 2. Descriptive statistics of different variables in pre- and post-intervention patients with adhesive capsulitis treated with IFT and exercises

Variables	Pre-intervention patients with IFT plus shoulder exercises		Post-intervention patients with IFT plus shoulder exercises		t-value	p-value
	Mean	SD	Mean	SD		
SAB (degree)	80.93	20.88	93.66	21.65	2.318	**<0.024**
SFL (degree)	102.70	16.12	115.56	15.56	3.144	**<0.003**
SEXT (degree)	39.33	8.88	47.66	7.73	3.875	**<0.001**
SEXTR (degree)	29.83	9.95	36.50	10.01	2.586	**<0.012**
SINTR (degree)	44.33	14.00	55.16	12.89	3.117	**<0.003**
VAS	7.97	0.85	7.97	0.92	0.001	1.000
PSCL (%)	83.66	8.58	80.00	9.36	1.581	0.119
DIS (%)	81.78	5.84	77.77	7.87	2.241	**<0.029**
TSPADI (%)	82.99	6.25	78.53	8.06	2.395	**<0.020**

Table 3. Descriptive statistics of different variables in post-intervention patients with adhesive capsulitis treated with Maitland plus IFT and IFT plus shoulder exercises

Variables	Patients treated with Maitland plus IFT		Patients treated with IFT plus shoulder exercises		t-value	p-value
	Mean	SD	Mean	SD		
SAB (degree)	33.50	18.80	44.33	14.00	2.531	**<0.014**
SFL (degree)	75.33	15.36	93.66	21.65	3.782	**<0.001**
SEXT (degree)	103.50	17.32	115.56	15.56	3.803	**<0.001**
SEXTR (degree)	42.33	6.79	47.66	7.73	2.838	**<0.006**
SINTR (degree)	32.50	14.06	36.50	10.01	2.169	**<0.021**
VAS	6.93	0.64	7.97	0.92	0,687	0.495
PSCL (%)	73.40	6.56	80.00	9.36	3.161	**<0.003**
DOS (%)	71.20	5.36	77.76	7.86	3.776	**<0.001**
TSPADI (%)	72.43	5.42	78.53	8.06	3.439	**<0.001**

DISCUSSION

The findings of the present study showed that the post-intervention patients treated with Maitland plus IFT had significantly (p<0.031-0.001) higher mean values in SAB, SFL, SEXT, SEXTR, SINTR, PSCL, DIS and TSPADI than their pre-intervention patient counterparts (Table 1), highlighting significant increment in ROM at all the planes and decrement in pain and disability in patients. These differences were, might be, due to mechanical force during mobilization which helps in breaking of adhesions, realigning collagen or increasing fiber glide where as IFT stimulates cutaneous sensory nerves and causes slight vasodilatation, which enhances the analgesic effects, thus reducing pain and increasing range of motion of joint. Phukon *et al.* (2017) reported that Maitland mobilization had remarkable improvement than muscle energy technique in adhesive capsulitis. Muhamed *et al*, (2018) opined that position induced movement re-education combined with low level laser therapy over active free shoulder exercises was much better than Maitland mobilization in patients with adhesive capsulitis. Cheing *et al.* (2008) confirmed IFT gave much better results than electro-puncture in patients with adhesive capsulitis.

The post-intervention patients treated with IFT plus shoulder exercises had significantly (p<0.024-0.001) higher mean values in SAB, SFL, SEXT, SEXTR and SINTR (55.16°), and significantly (p<0.029-0.020) lesser mean values in DIS and TSPADI than their pre-intervention patient counterparts (Table 2). These differences were, might be, due to, exercises which help to prevent atrophy of the shoulder girdle muscles by providing the early motion of joint structures and synovial fluid. However, IFT increased endogenous opioids release which acted as analgesic thus helped in reducing pain and increased range of motion in shoulder joint. Diercks *et al.* (2007) conducted a study to compare the effect of intensive physical rehabilitation treatment, which included passive stretching and manual mobilization (stretching group) versus supportive therapy and exercises within

the pain limits (supervised neglect group) in which they supported the effectiveness of exercises with in pain limits helped in increasing range of motion in adhesive capsulitis. Carette *et al.* (2003) confirmed that adding supervised exercise program showed faster improvement in shoulder range of motion. Celik *et al.* (2016) also supported the results of the study and reported that stretching gave more reliable results than matrix rhythm therapy. Dewan *et al.* (2011) confirmed that TENS and IFT both were effective but IFT was more effective in reducing pain intensity and restoring shoulder functions in patients with adhesive capsulitis.

When comparisons were made between the post-intervention patients with adhesive capsulitis treated with Maitland plus IFT and IFT plus shoulder exercises, The patients treated with IFT plus shoulder exercises had significantly ($p<0.021$-0.001) higher mean values in SAB, SFL, SEXT, SEXTR, SINTR, PSCL, DIS and TSPADI than the patients treated with Maitland plus IFT (Table 3). The results of this study showed that both treatment groups had significant improvement but the combination of IFT plus shoulder exercises showed significantly greater improvements than Maitland plus IFT. The better efficacy of the combination of IFT plus shoulder exercises was because of the shoulder pendulum exercises helped in increasing range of motion without stressing the structures around the shoulder joint and these exercises used the effect of gravity to distract the humerus from glenoid fossa. Thus, shoulder exercises helped in relieving pain through gentle traction and oscillating movements. Shoulder exercises helped in stimulating mechanoreceptors by inducing pain gate mechanism. Stasinopoulos and Johnson, (2004) suggested that the treatment regimen of supervised exercise program should be at least 3 times per week for 4 weeks. Small sample size and short duration of follow up were the limitations of the study.

CONCLUSION

The findings of the present study showed that both Maitland mobilization plus IFT and IFT plus shoulder exercises had significant improvement in shoulder range of motion and decrement in pain and disability after 6-week intervention in patients with adhesive capsulitis, though the combination of IFT plus shoulder exercises showed significantly better improvement than Maitland plus IFT.

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Conflict of Interest

Nil.

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