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Research Article

EFFECTIVENESS OF MOTOR CONTROL AND STRENGTHENING EXERCISE ON PAIN, FUNCTION AND THE RANGE OF MOTION IN PATIENTS WITH SHOULDER IMPINGEMENT SYNDROME

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A B S T R A C T

Background: Shoulder impingement syndrome can result in pain, weakness and loss of movement at the shoulder. Shoulder pain, exacerbated by lifting the arm, occurs mainly due to reduction in the subacromial space resulting from inappropriate movement between glenohumeral and scapulothoracic joints (scapular dyskinesis) due to a decreased ability of muscles to control movement, muscle weakness and hypotonia5-9. A recent intervention based on the "Exercise control theory" is an exercise program that emphasizes to correct inappropriate movements at the scapulothoracic joint by correcting muscle imbalance using manual, visual or verbal feedback and strengthening weakened musculature11, 18.
Study Design: Pre and post, experimental and control group study design.
Objectives: The aim of the study was to evaluate the effect of shoulder control and strengthening exercises, on the shoulder function of persons with shoulder impingement.
Methodology: Both groups received conservative therapy for 5 sessions per week for 3 weeks. The shoulder control and strengthening exercises group practiced additional motor control and strengthening exercises for 30 minutes. Values of the pain, function, and the range of motion were compared with those of the conservative therapy group.
Result: There were significant differences in the amount of change of the pain, function and range of motion between the two groups.
Conclusion: These results suggest that a motor control and strengthening exercise program is feasible and suitable for individuals with shoulder impingement syndrome.

INTRODUCTION

The shoulder joint has the most extensive range of motion (ROM) among the joints in the human body and it is easy to damage due to subluxation, dislocation and ligament tear[1, 2]. Shoulder impingement syndrome (SIS) is a disease of the shoulder joint and its incidence is 44-65% of all the cases of shoulder disease. The term SIS was introduced by Neer (1972) and it is also called supraspinatus syndrome and painful arc syndrome[3]. In many cases, this disease shows a chronic prognosis and pain and impairment due to functional restriction. The causes of SIS are an irregular shape of the acromion, rotator cuff weakness, muscle imbalance around the shoulder, kinematic dysfunction between the glenohumeral and scapulothoracic joints, an insufficient blood supply, degenerative change and trauma[1, 4]. Shoulder pain is exacerbated by lifting the arm, especially in forward bending like flexion, and the decreased ability to control the muscles due to inappropriate movement between the glenohumeral and scapulothoracic joints, muscle weakness, hypotonia and abnormal myotonus may lead to instability of the shoulder joint and a decrease of the subacromial space[5-9].

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Normal scapular motion is closely integrated with arm motion to provide efficient scapulohumeral rhythm in shoulder function. This rhythm is often disrupted in patients with symptoms and signs of shoulder impingement.

Movement deficits have been observed in persons with musculoskeletal disorders [17-19]. A cortical reorganization consecutive to peripheral impairments may explain such deficits [20-22]. Interestingly, it has been demonstrated that movement training can induce change in the cortical organization of healthy subjects [23] and contribute to the improvement of the motor performance in persons with peripheral impairments[18, 24]. In order to efficiently rehabilitate the deficits, movement training should, however, be based on the best strategies available to favour motor learning. Factors such as the use of instruction, demonstration and extrinsic feedback during movement training have been proved to promote motor learning [25-27]. Among them, extrinsic feedback is one of the most potent factors [26].

Extrinsic feedback is given by an external source and provides error information that can be used in addition to the person's own intrinsic error signals[25].

A large percentage of patients with shoulder impingement have scapular dyskinesis and alterations in the normal resting position of the scapula or in dynamic scapular motion. Scapular dyskinesis usually manifests as a loss of control in the motions of scapular external rotation and the translation of scapular retraction. This loss of control results in alteration in timing and magnitude of acromial upward rotation, excessive anterior tilting of the glenoid, and loss of maximal rotator cuff muscle activation capability. These pathophysiologic and pathomechanical alterations cause or increase the dysfunction associated with impingement.

According to previous studies of SIS intervention, the effects of nonsurgical methods such as administering pharmacotherapeutic drugs to the subacromial bursa (local anesthesics, steroid or NSAIDs), using a brace, ultrasound, electrical stimulation, stretching, strengthening exercise and manual therapy has been verified [2, 10-12.] A recent notable intervention is an exercise program that emphasizes appropriate movement aiming to strengthen the muscle power of the shoulder joint. Intervention methods based on exercise control theory have been prescribed for musculoskeletal patients.

According to this theory, abnormal movement by damage or disease reorganizes the cerebral cortex, finally leading to changes in the brain [7, 13] and the altered brain is reorganized by performing the correct exercise strategy [14, 15]. Based on this, normal movement can be achieved without inflammation and pain of the subacromial tissue [16, 28]. Roy *et al.* (2009) reported that intervention based on motor control theory for SIS patients changed the quality of the activity of the shoulder bones and muscles and it improved the abnormal movement and instability of the glenohumeral and scapulothoracic motion and the sternoclavicular joint [29]. From the kinetical aspect, this result showed an improved ability to control movement and the importance of exercise control as an intervention for SIS patients.

Need of the Study

There is increasing evidence to show the presence of scapular dyskinesis in patients with shoulder impingement[13-16]. According to the motor control theory abnormal movement by damage or disease reorganizes the cerebral cortex, finally leading to changes in the brain[7, 10]. The altered brain is reorganized by performing the correct exercise strategy[11, 12]. Based on this; normal movement can be achieved without inflammation and pain of the subacromial tissue. Studies have indicated that feedforward strategies of the vasti in people with patellofemoral pain syndrome can be changed by a physical therapy treatment program in a randomized, double blind, placebo controlled trial[31].

Many studies have reported the effectiveness of exercise programs in treatment of shoulder impingement syndrome as a nonsurgical intervention but research on the combination of motor control and muscle strengthening exercise is currently insufficient.

Although Roy *et al.* (2009) reported that a combination of motor control and muscle strengthening exercise decreased pain and improved function[30], this research had a single-subject design and the author noted the need for a control group in a further study. Thus, the aims of this study were to investigate the effects of a combination of motor control and muscle strengthening exercise on pain, function, strength and range of motion of SIS patients and to develop a more effective intervention method. Moreover, this study provides basic research material for further study of motor control and rehabilitation of SIS patients.

Objectives

The aims and objectives of the study are

- To investigate the effects of motor control exercise on pain, function and range of motion of shoulder impingement syndrome patients.
- To investigate the effects of muscle strengthening exercise on pain, function and range of motion of shoulder impingement syndrome patients.

Hypothesis

Alternate hypothesis

There will be statistically significant improvement in pain, function and range of motion in patients with shoulder impingement syndrome.

Null hypothesis

There will be no statistically significant improvement in pain, function and range of motion in patients with shoulder impingement syndrome.

METHODOLOGY

Study Design

The study design adopted is a pre and post test, control group and experimental group design.

Source of Data

Patients diagnosed with shoulder impingement syndrome and referred to Physiotherapy department of City Hospital Research and Diagnostic Centre, Mangalore.

Definition of Study Subjects

Patients diagnosed with shoulder impingement syndrome aged between 35-55yrs.

Criteria for Selection

Inclusion Criteria

The inclusion criteria are

- Patients diagnosed with shoulder impingement syndrome
- Age group 35-55yrs.
- Both male and female.
- Normal elbow and hand function.
- Patients who were willing for the study.

Exclusion Criteria

The exclusion criteria are

- A typeIII acromion,
- Calcification or fracture of the scapula, clavicle or humerus.
- Shoulder instability
- Previous shoulder surgery
- Cervicobrachialgia or shoulder pain during neck movement.

- Neurological deficit in upper extremity.

Sample-Design

Non- probability convenient sampling was used.

Sample-Size

The sample consists of 30 patients with shoulder impingement syndrome fulfilling inclusion exclusion criteria.

Follow Up

Pre- test assessment was taken for pain and disability using Shoulder pain and disability index (SPADI) on the first day before starting treatment.

Post test assessment was taken on last day of the treatment using SPADI.

Range of motion both pretest and posttest was assessed using goniometry.

Parameters and Statistical Tests Used

The paired t test was used to compare the pain, function and range of motion in the same group between the pre and post intervention tests. Independent t tests were used to test for differences between the experimental and control groups.

Duration of Study

Study was conducted over a period of 12 months.

METHODOLOGY

The 30 participants were randomly assigned to two groups:
Group A-control group and
Group B -experimental group.

Group A-control group underwent conventional physical therapy for 45 min per day, five times a week for 3 weeks.
Conventional treatment consisted of ultrasound for five minutes, TENS for fifteen minutes, active shoulder mobilization exercise and passive stretching.

Group B-experimental group underwent the motor control and strengthening exercise for additional 30 min. after performing conservative physical therapy for 45 min per day, five times a week for 3weeks.

Shoulder control exercises progressed following 6-phase retraining exercises to control arm elevation in the frontal, sagittal and scapular planes. Movement training was performed under the supervision of a physiotherapist who gave feedback aimed at correcting the shoulder girdle movement. The retraining phases were graded according to: the level of resistance applied to the shoulder during arm elevation (no resistance/passive movement, active assisted, active with or without external resistance); and the use of feedback during the movement. . The phases ranged from no resistance with feedback to active movement with external resistance without feedback. During each retraining phase, the ROM was gradually increased as shoulder control improved until proper control was achieved for the full ROM in each vertical plane. When the subject was able to perform a series of 10 repetitions with proper control, exercise series were added to reach three. The subject then moved up to the next phase. Once abduction over a range of 90 degrees was properly controlled, humeral lateral rotation at 90 degrees of abduction was performed.
The strengthening exercises were performed to increase the muscle strength around the scapulothoracic and scapulohumeral joints. The strengthening exercises included; external rotation and internal rotation, scaption, chair press, push-up plus, press-up, rows, upright rows, and low trapezius exercise. Each exercise performed as 3 sets of 10 repetitions.

A 10-min rest period was provided between the motor control and the strengthening exercise. All exercises were performed pain free. Before the exercise, the physical therapist educated the subjects about the exercise programs using illustrations.
Outcome measures used were shoulder pain and disability index (SPADI) and goniometry.

Table 1 Manual feedback was given according to scapular dyskinesis

Types of dyskinesis	Manual feedback
Decrease of the scapula lateral rotation	Guidance of lateral rotation with lateral pressure placed on the inferior angle of the scapula
Tilt of the scapula inferior angle	Restriction of the tilt with anterior pressure placed on the inferior angle of the scapula
Elevation of the superior border of the	Restriction of the scapular elevation with inferior pressure placed on the acromion Scapula
Tilt of the medial scapula border	Restriction of the tilt with anterior pressure placed on the medial border of the scapula

Table 2 Phase for retraining the shoulder control according to scapular dyskinesis

Phases	Steps for retraining the shoulder control			
	1	2	3	4
1[a]	Passive elevation	Final position actively kept for 5 sec	Active return with manual feedback if needed	Verbal feedback
2[a]	Active assisted elevation	Final position actively kept for 5 sec	Active return with manual feedback if needed	Verbal feedback
3[a]	Active elevation with manual feedback if needed	Final position actively kept for 5 sec	Active return with manual feedback if needed	Verbal feedback
4[a]	Phase 3, but without manual feedback			
5	Phase 4, but without visual feedback			
6	Phase 5, but with the elevation performed faster, and then with a load			

[a] In front of a mirror (visual feedback)

Table 3 Muscle strengthening exercise

Exercise	Description
Internal rotation & External rotation	Hold the elbow at 90° with the arm at the side. Pull the hand away (external rotation) from the body. Pull the hand across (internal rotation) the body.
Scaption	Hold the arm 30° forward, thumb up or down, and raise the arm. May add resistance. This exercise should be done only if there is no pain.
Chair press	While seated, press up on the chair to lift the body off the chair. Try to keep the spine straight
Push-up plus	Do a push-up (either on your hands or forearms) and then really push to bring your spine to the ceiling.
Press-up	Lie on the back, elbows locked straight, weights in hands. Move your arm up toward the ceiling as far as possible.
Rows	Seated or standing, bend your elbows and pull back. Try to pinch your shoulder blades behind you.
Upright row	Do one arm at a time. While standing, lean over a table and bend at the waist. Pull the hand weight back with pulling the shoulder blade back.
Lower trapezius	Stand upright. Hold weights in your hands. Keep your elbows straight and pull. Try to reach behind you.

Statistical analysis

Collected data was analyzed by descriptive methods such as frequency, percentage, mean and standard deviation. Comparison of effect within the group was done by paired t test and comparison of an effect between the groups by unpaired t test

p value > 0.05, NS (Not significant)
0.01 < p value < 0.05, sig(significant)
0< pvalue < 0.01, HS(highly significant)

Table 4 Age wise comparison of control and experimental groups

Age	Group		Total
	Experimental	Control	
36 - 40	1 6.7%	3 20.0%	4 13.3%
41 - 45	5 33.3%	3 20.0%	8 26.7%
46 - 50	4 26.7%	5 33.3%	9 30.0%
51 - 55	5 33.3%	4 26.7%	9 30.0%
Total	15 100.0%	15 100.0%	30 100.0%

Fishers exact test p=.620, NS

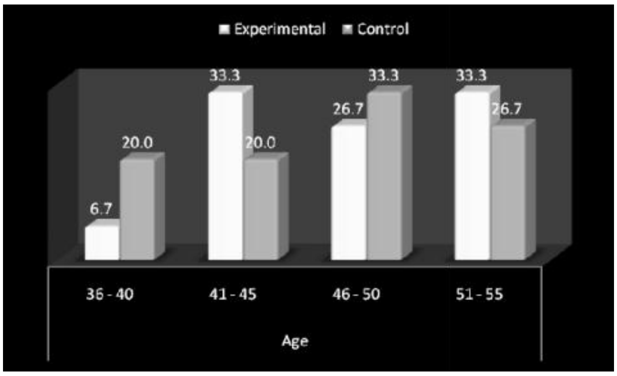

Table 5 Comparison of mean age

Group	N	Minimum	Maximum	Mean	Standard Deviation	t value	p value	
Experimental	15	39	55	47.80	5.088	605	0.550	NS
Control	15	36	54	46.60	5.755			
Total	30	36	55	47.20	5.372			

Table 6 Comparison of male female subject ratio

Sex	Group		Total
	Experimental	Control	
F	9 60.0%	9 60.0%	18 60.0%
M	6 40.0%	6 40.0%	12 40.0%
Total	15 100.0%	15 100.0%	30 100.0%

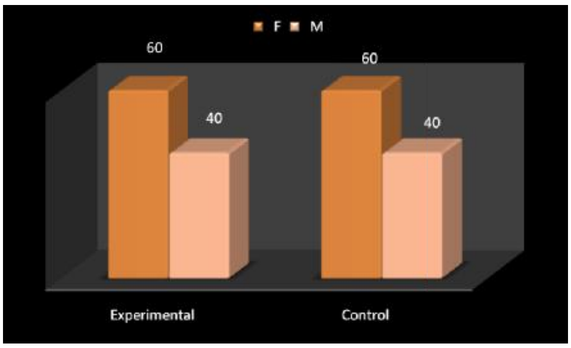

Table 7 Comparison of parameters between experimental and control group before the treatment

Parameters	Group	N	Minimum	Maximum	Mean	Standard Deviation	T Value	P Value	
SPADI	Experimental	15	49	104	76.87	16.76	1.85	0.074	NS
	Control	15	38	91	65.27	17.50			
	Total	30	38	104	71.07	17.84			
Flexion ROM	Experimental	15	110	160	136.00	15.61	0.21	0.832	NS
	Control	15	90	170	134.33	25.83			
	Total	30	90	170	135.17	20.99			
Abduction ROM	Experimental	15	80	155	120.33	17.47	0.33	0.746	NS
	Control	15	87	160	122.80	23.45			
	Total	30	80	160	121.57	20.35			
External Rotation ROM	Experimental	15	15	60	39.20	15.36	0.14	0.888	NS
	Control	15	15	65	40.00	15.58			
	Total	30	15	65	39.60	15.21			
Internal rotation ROM	Experimental	15	10	50	32.00	14.86	0.55	0.586	NS
	Control	15	10	60	35.00	15.00			
	Total	30	10	60	33.50	14.75			

There is no significant difference between experimental and control group and p >0.05 in all the cases

Table 8 Pre and post comparison of SPADI in experiment and control group

Group		N	Minimum	Maximum	Mean	Standard Deviation	Change (%)	t value	p value	
Experimental	Pre	15	49	104	76.87	16.76	42.06	22.06	P<0.001	HS
	Post	15	22	71	44.53	15.31				
Control	Pre	15	38	91	65.27	17.50	24.21	15.35	P<0.001	HS
	Post	15	25	74	49.47	15.13				

SPADI score in experimental group before the treatment was 76.87 ± 16.76 and that of after the treatment it was 44.53 ± 15.31, with 42.06% improvement. In control group before the treatment SPADI score was 65.27 ± 17.50 that of after the treatment it was 49.47 ± 15.13, with 24.21% improvement. t test shows that there is significant change in both the groups after the treatment as p<0.001 in both the groups.

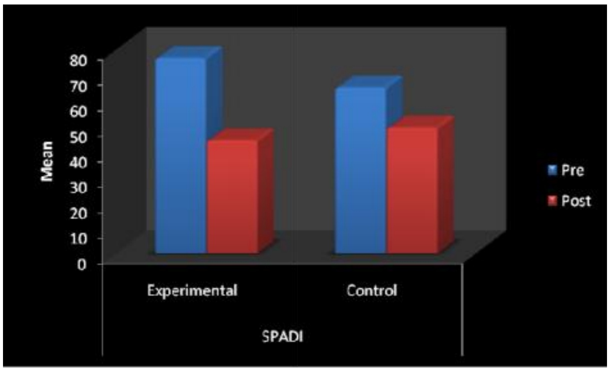

Table 9 Comparison of SPADI scores between the groups

Group	N	Mean Difference	Standard Deviation Of Difference	Change (%)	tvalue	pvalue	
Experimental	15	32.33	5.678	42.06	9.23	P<0.001	HS
Control	15	15.80	3.986	24.21			

In experimental group 42.06% improvement and that of in control group 24.21% improvement, which is significantly less compare to experimental group as p<0.001.So experimental group is more effective compare to control group

Flexion ROM in experimental group before the treatment was 136.00 ± 15.61 and that of after the treatment it was 155.33 ± 14.33, with 14.22% improvement. In control group before the treatment flexion ROM was 134.33 ± 25.83 that of after the treatment it was 145.33 ± 25.98, with 8.19% improvement. t test shows that there is significant change in both the groups after the treatment as p<0.001 in both the groups.

Table 10 Pre and post Comparison of flexion ROM in experimental and control groups

Group		N	Minimum	Maximum	Mean	Standard Deviation	Change (%)	t value	p value	
Experimental	Pre	15	110	160	136.00	15.61	14.22	15.12	P<0.001	HS
	Post	15	130	180	155.33	14.33				
Control	Pre	15	90	170	134.33	25.83	8.19	8.42	P<0.001	HS
	Post	15	95	180	145.33	25.98				

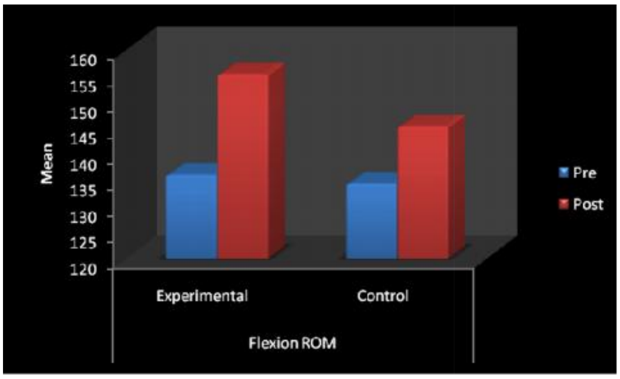

Table 11 Comparison of flexion ROM between the groups

Group	N	Mean Difference	Standard Deviation Of Difference	Change (%)	tvalue	pvalue	
Experimental	15	19.33	4.952	14.22	4.56	P<0.001	HS
Control	15	11.00	5.057	8.19			

In experimental group 14.22% improvement and that of in control group 8.19% improvement, which is significantly less compare to experimental group as p<0.001.

So experimental group is more effective compare to control group

In experimental group 26.00% improvement and that of in control group 7.47% improvement, which is significantly less compare to experimental group as p<0.001.

So experimental group is more effective compare to control group

External rotation ROM in experimental group before the treatment was 39.20 ± 15.36 and that of after the treatment it was 56.13 ± 17.34, with 43.20% improvement. In control group before the treatment external rotation ROM was 40.00 ± 15.58 that of after the treatment it was 44.73 ± 15.68, with 11.83% improvement. t test shows that there is significant change in both the groups after the treatment as p<0.001 in both the groups.

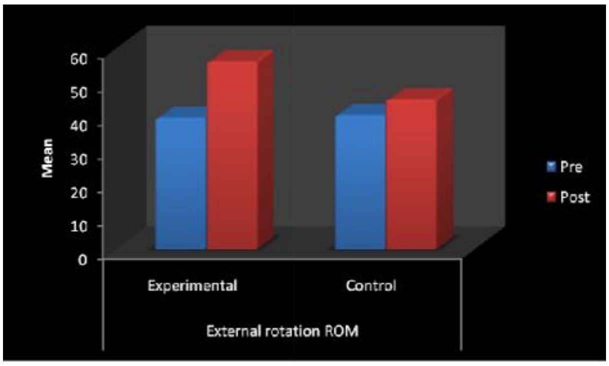

Table12 Pre and post comparison of abduction ROM in experiment and control groups

Group		N	Minimum	Maximum	Mean	Standard Deviation	Change (%)	t value	p value	
Experimental	Pre	15	80	155	120.33	17.47	21.61	12.16	P<0.001	HS
	Post	15	120	170	146.33	14.33				
Control	Pre	15	87	160	122.80	23.45	6.08	13.55	P<0.001	HS
	Post	15	95	165	130.27	22.84				

Abduction ROM in experimental group before the treatment was 120.33 ± 17.4 and that of after the treatment it was 146.3 ± 14.3, with 21.61% improvement. In control group before the treatment abduction ROM was 122.80 ± 23.45 that of after the treatment it was 130.27 ± 22.84, with 6.08% improvement. t test shows that there is significant change in both the groups after the treatment as p<0.001 in both the groups.

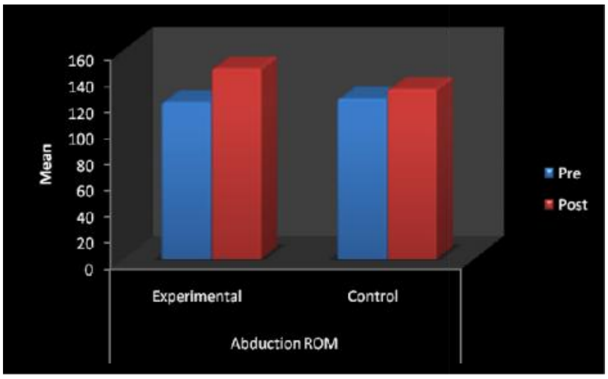

Table 13 Comparison of abduction ROM between the groups

Group	N	Mean Difference	Standard Deviation of Difference	Change (%)	t value	p value	
Experimental	15	26.00	8.281	21.61	8.39	P<0.001	HS
Control	15	7.47	2.134	6.08			

Table 14 Pre and post comparison of external rotation ROM in experimental and control groups

Group		N	Minimum	Maximum	Mean	Standard Deviation	Change (%)	t value	p value	
Experimental	Pre	15	15	60	39.20	15.36	43.20	13.37	P<0.001	HS
	Post	15	30	80	56.13	17.34				
Control	Pre	15	15	65	40.00	15.58	11.83	7.19	P<0.001	HS
	Post	15	17	70	44.73	15.68				

Table 15 Comparison of external rotation ROM between the groups

Group	N	Mean Difference	Standard Deviation of Difference	Change (%)	t value	p value	
Experimental	15	16.93	4.906	43.20	8.55	P<0.001	HS
Control	15	4.73	2.549	11.83			

In experimental group 43.20% improvement and that of in control group 11.83% improvement, which is significantly less compare to experimental group as p<0.001.

So experimental group is more effective compare to control group

control training that gives feedback can change the exercise strategy and improve movement control from a kinematic point of view, and their results showed the effects of motor control training conducted for patients with shoulder impingement syndrome[28].

Table 16 Pre and post comparison of internal rotation between experimental and control groups

Group		N	Minimum	Maximum	Mean	Standard Deviation	Change (%)	t value	p value	
Experimental	Pre	15	10	50	32.00	14.86	41.67	8.79	P<0.001	HS
	Post	15	15	65	45.33	17.27				
Control	Pre	15	10	60	35.00	15.00	10.86	7.76	P<0.001	HS
	Post	15	15	65	38.80	14.91				

Internal rotation ROM in experimental group before the treatment was 32.00 ± 14.86 and that of after the treatment it was 45.33 ± 17.27, with 41.67% improvement. In control group before the treatment Internal rotation ROM was 35.00 ± 15.00 that of after the treatment it was 38.80 ± 14.91, with 10.86% improvement. t-test shows that there is significant change in both the groups after the treatment as p<0.001 in both the groups.

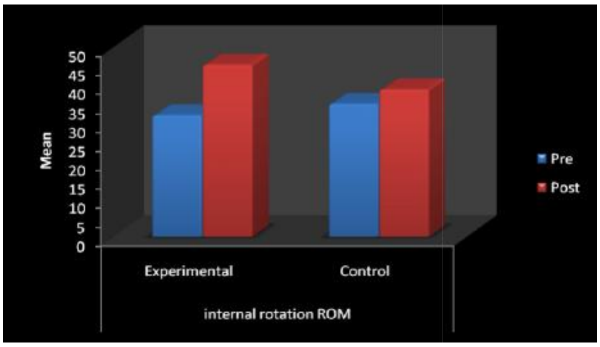

Table 17 pre and post comparison of internal rotation ROM between experimental and control groups

Group	N	Mean Difference	Standard Deviation Of Difference	Change (%)	t value	p value	
Experimental	15	13.33	5.876	41.67	5.98	P<0.001	HS
Control	15	3.80	1.897	10.86			

In experimental group 41.67%improvement and that of in control group 10.86% improvement, which is significantly less compare to experimental group as p<0.001. So experimental group is more effective compare to control group

After completion of 3 weeks intervention, the SPADI was significantly decreased compared with before intervention (p<0.001) in both groups. There was significant difference between the experimental group and control group at post intervention (p<0.001). In all ranges of motion, flexion, abduction, external rotation and internal rotation were significantly increased compared with before intervention (p<0.001) in both groups. There was significant difference between the experimental group and control group at post intervention (p<0.001).

DISCUSSION

The dynamic stability of the glenohumeral joint is required for muscle activation at the appropriate time and balanced control of the shoulder muscles. Moreover, this dynamic stability has been shown to be disturbed in patients with shoulder impingement. Roy *et al*. (2009) reported that motor

All the patients of the study showed signs of scapular dyskinesis during the performance of elevation in all planes. As treatment progressed with manual visual and verbal feedback patients began to get more control over the dyskinesis and were gradually able to correct it themselves. Thus, feedbacks could gradually be reduced till movements were performed independently with improvements in pain and ROM. Surenkok O *et al* achieved similar results with scapular mobilization on pain and ROM.[37]

The study showed a decrease in pain and a positive effect on function recovery represented by the decreased SPADI score in the experimental group, and there were statistically significant differences between the experimental group and the control group in the SPADI. Several previous studies conducted single exercise programs and they reported that pain and function were improved in both the exercise and the control groups, with no significant differences between the groups[32, 33]. However, Senbursa *et al*. (2007) reported that a group following a manual therapy with exercise program and an exercise only program resulted in decreases in pain and improvement of function[3], but as statistically significant improvements were found only in the manual therapy with exercise program group, as was noted in this study.

These results suggest that strengthening exercise with intervention aiming to achieve proper motion is more useful for increasing joint mobility, decreasing pain and improving the functional ability than strengthening exercise alone[3, 34]. The functional stability of the shoulder joint requires an appropriate couple force from the rotator cuff muscles and accurate timing of the muscle activation[6]. The cocontraction of muscles and the degree of activation of each muscle with appropriate movement are important factors for the coordination of muscles. Very tiny changes of shoulder muscle movement can have an effect on the direction of movement and the power of the scapluohumeral joint[32, 35] and the vector of power in other shoulder muscle can show the presence of instability of the scapluohumeral joint [36, 37].

When a patient with shoulder impingement syndrome elevates his/her arms forward, the pain becomes severe, causing inconvenience in daily life because of the limitation of motion. Also, if it continues for a long period, then shoulder impingement can progress to frozen shoulder, so the recovery of range of motion is very important[8, 38, 39] A study by Senbursa *et al*. (2007) showed that range of motion was significantly increased when a group that received a manual therapy and strengthening program incorporating flexion, external rotation and abduction, but the range of motion was not significantly increased when another group received only the strengthening program.[3] In this study, the range of motion of flexion, internal rotation, external rotation and abduction for the experimental group was significantly increased compared with that of the control group. This means that motor control and strengthening training helps the proper movement strategy [11, 12] and the recovery of range of motion [7, 17, 25] by controlling inappropriate motion so patients can elevate their arms without any pain.

The results show that motor control and strengthening exercises for patients with shoulder impingement syndrome were effective at improving pain, function and the range of motion. Therefore, the results of this study suggest an effective training method for improving pain, function and the range of motion of shoulder impingement syndrome patients, and also provide basic data for future studies on the rehabilitation of such patients. The study had a small sample size and individuals of age group of only 35-55 were involved in this study. Further studies can measure effectiveness of motor control exercise on other outcome parameters of shoulder impingement patients. Also the effectiveness of this protocol can also be studied in other shoulder syndromes in which scapular dyskinesis exists. Further studies can be conducted using specific population groups such as athletes, office workers or diabetics.

CONCLUSION

The study concludes that as compared to conservative treatment alone, motor control exercise and strengthening exercise combined with conservative treatment are more effective in relieving pain and increasing ROM in patients with shoulder impingement syndrome.

Summary

A study was conducted on 30 patients of shoulder impingement syndrome age 35-55 to study the effectiveness of motor control exercise and strengthening exercise as compared to conservative treatment. The subjects were divided into experimental groups (number of subjects = 15) and control group (number of subjects = 15). The control group received conservative treatment while the experimental group received motor control and strengthening exercises in addition to conservative treatment. The conservative treatment consisted of ultrasound TENS, shoulder mobilization exercise and stretching. Shoulder control exercises progressed through 6-phases of retraining exercises to control arm elevation in the frontal, sagittal and scapular planes. Movement training was performed under the supervision of a physiotherapist who gave feedback aimed at correcting the shoulder girdle movement. The strengthening exercises included; external rotation and internal rotation, scaption, chair press, push-up plus, press-up, rows, upright rows, anlow trapezius exercise. Each exercise performed as 3 sets of 10 repetitions.

Both groups received conservative therapy for 5 sessions per week for 3 weeks. The shoulder control and strengthening exercises group practiced additional motor control and strengthening exercises for 30 minutes during each session. At the end of three weeks values of the pain, function, and the range of motion were compared with those of the conservative therapy group. Outcome parameters used were SPADI and ROM. There was statistically significant difference in improvement between experimental and control groups. The results show that as compared to conservative treatment motor control exercise and strengthening exercise are more effective in relieving pain and increasing ROM.

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