Effects of Motor Control Exercise on Shoulder Pain and Work Performance among welders

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ABSTRACT

Welders often report musculoskeletal disorders in the shoulder joint is most commonly involved. In this study, Shoulder pain is treated with motor control exercise. Motor control exercise re-educating the muscle activation for reducing shoulder pain and improving functional activities among welders. The objective of this study is to find out the effects of motor control exercise on shoulder pain and work performance among welders. Quasi-experimental design, pre- and post-type with 30 subjects. Group A (experimental group) consists of 15 subjects who were treated with motor control exercise for the shoulder complex. Group B (control group) consists of 15 subjects who were treated with free exercise for the shoulder joint. There was a significant difference between the Intervention and Control group in SPADI score and work performance scale. The 't' test value of SPADI and work performance of the intervention group was -2.074 and 4.811, respectively, with a p value < 0.05. Thus, there was a significant difference between Group A and Group-B in SPADI and work performance among welders. CONCLUSION: The study concludes that six weeks of motor control exercise have an effect on pain reduction and improvement in work performance among welders.

INTRODUCTION

Shoulder joint is considered as weak joint because it has more mobility than stability. Ligament of the shoulder joint plays a major role in stabilizing the bony structure. Shoulder pain is associated with industrial population globally, people often report the complaint of shoulder pain. It caused by repetitive strain, sudden twisting movement, awkward posture and this results in pain, stiffness and reduction in joint range of motion[1,2].

Decrease muscle strength, limited functional activities and work endurance are frequently reported by workers[3].It causes sickness absenteeism because of pain complaints; industry faces economical loss and workers reduced

their follow up. The workers show significance muscle weakness, decreased motor control of the shoulder joint during functional activities as well as work performance. Some literatures show person who have shoulder pain often reports neurological and proprioception deficits[4].Welders without proper precautions cause work related problems to the involved structure[5,6].

Musculoskeletal disorders are the important causes for poor work performance of workers during past decades. They have an impact on work place that induce symptoms at an early age. Because of this improper position welders undergo wear and tear every time that leads musculoskeletal disorders. This wear and tear mechanism causes injury, damage and danger to the joint and other tissues in upper and lower limb or back. Many studies revealed that, welders are always connected with musculoskeletal disorders due to repetitive strain injury or cumulative trauma[7,8,9].

Motor control exercise is regaining the coordinated movement of muscle and it adjusting the inappropriate movement and it designed to improve muscle activation, obtain optimal control, reeducation of the muscle and dynamic stability of shoulder joint [10]. In these training program, exercise are given to stabilize the movement by learning normal movement through repetitive practice[11]. The exercises are targeting the specific muscle of shoulder region and to improve the quality of movement[12].

Intervention of motor control exercise program among welders is much more importance that prevent the further development of musculoskeletal disorders. The main aim of the management is to improve the functional activities as well as work performance[13]. Shoulder Pain and Disability Index (SPADI) were used to measure the shoulder pain and functional disabilities among welding workers. It has two dimensions; one is used to assess the pain rate and other for disability rate. Visual Analogue Scale (VAS) are psychometric measuring instrument designed to analyses the severity of individual pain and also used to measure the intensity of pain[14].

Work performance is an ability of the person to perform the job well. Determining this helps to aware about the state of workers and their functional involvement[15]. So, this study was done to find the effect of motor control training program for shoulder complex. And this program is used to determine the pain reduction rate and improvement of work performance among welders.

MATERIALS AND METHODS

Participants in the study were male, between 25 and 40 years old, reported shoulder pain with a VAS score of 3-5, had a minimum of five years of work experience, and possessed basic reading skills in Tamil or English. Individuals with a history of recent upper limb injury/fracture, previous shoulder surgery, neurological or cardiovascular abnormalities, or concurrent participation in other treatment program were excluded.

Study design and setting

"This quasi-experimental, pre- and post-test study, utilized convenient sampling of 30 subjects, was conducted over a 6-week period within welding shops in and around Maraimalai Nagar.

Participants and recruitment

Participants were selected based on the inclusion and exclusion criteria and informed consent was obtained after a detailed explanation of procedure. The subjects were given SPADI questionnaire for evaluating the intensity of pain and disability. The participants were divided into 2 groups each consist of 15 participants. Group-A (Experimental Group) were treated with motor control exercise for shoulder joint and Group B (Control Group) treated with free exercise of shoulder joint. Pre and posttest value of pain and disability assessed by using SPADI questionnaire and work performance was assessed by 5-point Likert rating scale from an employer.

GROUP-A MOTOR CONTROL TRAINING

The motor control exercise program is developed to retraining the muscle recruitment by correcting the scapula impairment. There are divided into two components: 1. Motor control exercise 2. Strengthening exercise MOTOR CONTROL EXERCISES This retraining muscle control exercise was given for scapular alignment/correction, and proper muscle coordination for learning correct resting scapular position and during active movements Scapular mobility during arm elevation can be improved with motor control exercise. This retraining exercise consists of 6-phase exercise that control frontal, sagittal and scapular plane elevation of shoulder. This 6-phase retraining exercise was based on the resistance applied on the shoulder elevation (phase start from no resistance to active movement with some external resistance). Visual and verbal feedback was given during the movement.

ROM was increased gradually on each retraining phase, until full ROM achieved in elevation. They were encouraged to perform this series to reach 3 set of 10 repetitions. After this the next phase was started. The 90^0 of shoulder abduction achieved with proper control, lateral rotation with 90^0 of abduction was performed. Strengthening exercise was performed to improve their muscle strength after their achievement of motor control.

PHASES	MOTOR CONTROL TRAINING			
I	Passive elevation	End range was actively maintained for 5 seconds.	Encourage active return. if needed manual feedback	Verbal and visual feedback
II	Active assisted elevation	End range was actively maintained for 5 seconds.	Encourage active return. if needed manual feedback	Verbal and visual feedback
III	Active elevation with manual feedback if needed	End range was actively maintained for 5 seconds.	Encourage active return. if needed manual feedback	Verbal and visual feedback
IV	Phase III, without manual feedback			
V	Phase IV, without visual feedback			
VI	Phase V, with the elevation performed faster, and then with a load			

GROUP B- STRENGTHENING EXERCISE

Exercise for specific muscle are introduced to control the optimal position of scapula. Each exercise was performed with10 repetitions twice a day and gradually increased up to 3 sets of 10 repetition. A 10-min rest period was provided between the motor control and the strengthening exercise.

EXERCISE	INSTRUCTION
External rotation & Internal rotation	Secure the thera band at the waist level. 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
Rows	Seated or standing, bend your elbows and pull the elastic cord back. Try to pinch your shoulder blades behind you.
Low trapezius Stand upright	Grasp the elastic bands. Keep your elbows straight and pull. Try to reach behind you.

DATA ANALYSIS

The data was analyzed using Statistical Package for Social Science version 20. The pre and post test was determined using paired t test and independent t test

FIGURES AND TABLES

TABLE 1

Comparison of pre & post test value of SPADI & work performance score of GROUP-A (Experimental Group)

	GROUP-A	MEAN	N	S.D	MEAN DIFF	t VALUE	DF	SIG
SPADI	PRE TEST	78.6000	15	8.03386	13.06667	5.997	14	.000
	POST TEST	65.5333	15	10.32934				
WORK PERFORMANCE	PRE TEST	2.6000	15	.91026	-1.20000	-5.392	14	.000
	POST TEST	3.8000	15	.86189				

P value <0.05 shows significant results

According to the Table 1, there is a significant reduction in pre and post values of SPADI score and improvement in work performance in Group-A with significant value p< 0.05.

GRAPH-1

Comparison of Mean Value of Pre and Post Test Value of SPADI And Work Performance Score in Group A (Experimental Group)

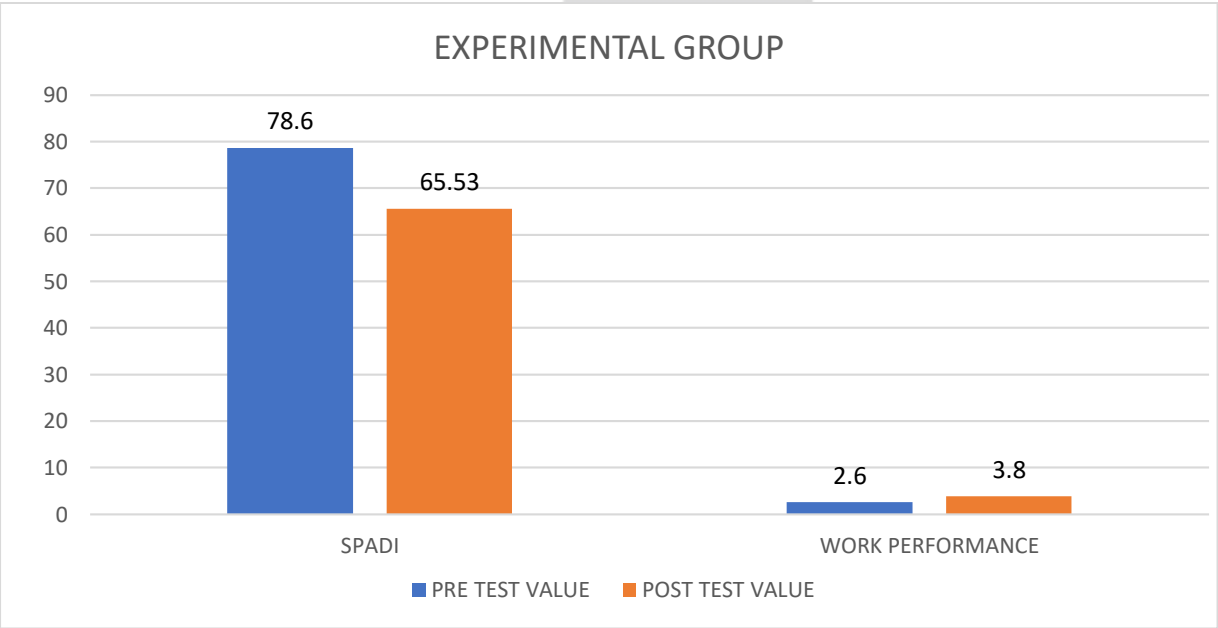


TABLE: 2

Shows the comparison of pre & post test value of SPADI & work performance score of GROUP B (control group)

	PRE /POST TEST	MEAN	N	S.D	MEAN DIFF	t VALUE	DF	SIG
SPADI	PRE	72.7333	15	9.23090	-.33333	-.517	14	.613
	POST	73.0667	15	9.55037				
WORK PERFORMANCE	PRE	2.4000	15	.91026	.13333	.695	14	.499
	POST	2.2667	15	.88372				

P value <0.05 shows no significant results

According to the table 2, there is a no significant reduction in pre and post values of SPADI and improvement of work performance in Group-B (P>0.05)

GRAPH-2

Comparison of mean value of pre and post test value of SPADI and work performance score in GROUP B (control group)

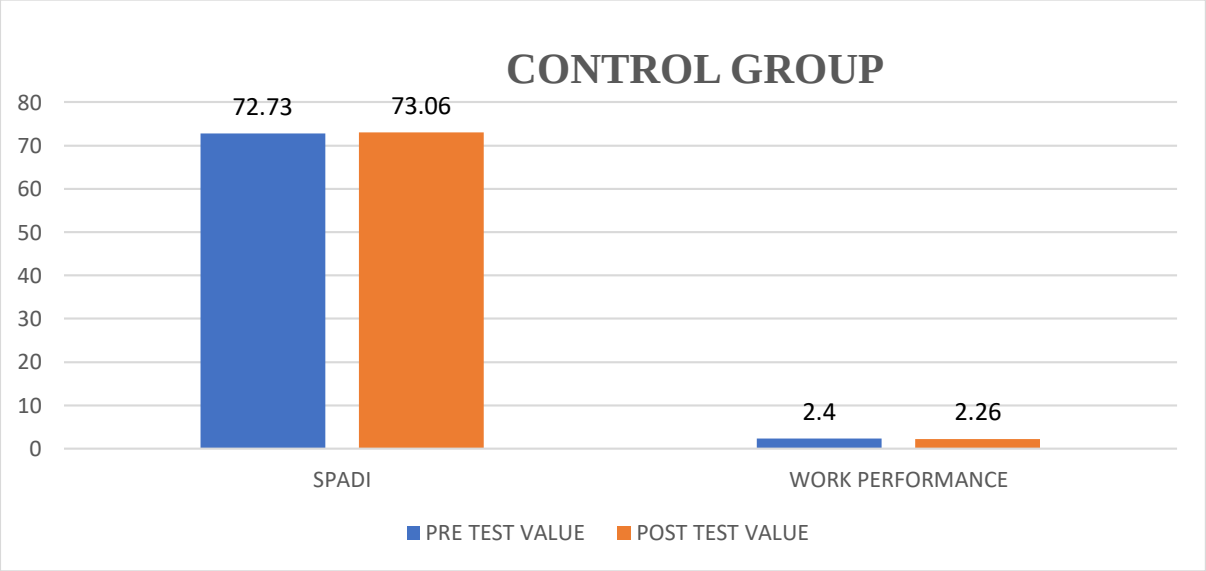
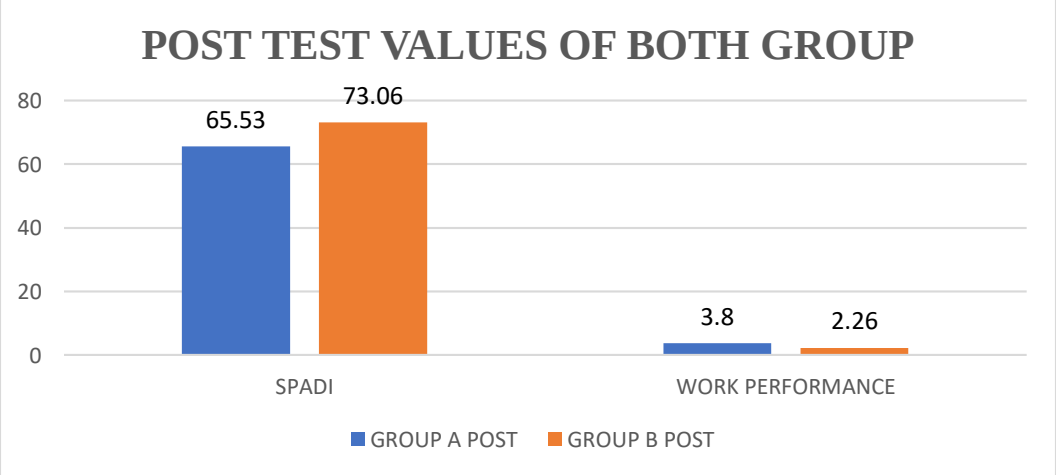


TABLE 3 Shows the comparison of post test value of SPADI & work performance score of GROUP A (Experimental group) and GROUP B (Control group)

GROUP-A AND B	POST TEST VALUE	MEAN	N	STD DEV	t VALUE	DF	SIG (2 TAILED)
SPADI	GROUP-A	65.5333	15	10.32934	-2.074	18	.047
	GROUP-B	73.0667	15	9.55037			
WORK PERFORMANCE	GROUP -A	3.8000	15	.86189	4.811	18	.000
	GROUP-B	2.2667	15	.88372			

GRAPH-3

Comparison of mean value of pre and post test value of SPADI and work performance score in GROUP A (Experimental Group) and GROUP B (Control Group)



RESULTS

According to the Table I and Graph I, there is a significant reduction in mean values of pre test (78.60) and post test (65.53) of SPADI score and also it shows improvements in the mean values of pre test (2.60) and post test (3.80) of work performance in Group-A treated with motor control exercise with significant value of $p<0.05$.

According to the Table II and Graph II, there is a no significant reduction in mean values of pre test (72.73) and post test (73.06) of SPADI and shows some changes in the mean values of pre test (2.40) and post test (2.26) of work performance in GroupB $P>0.05$.

According to the Table 3 and Graph 3, the 't' test value was -2.074 with a p value < 0.05. Thus there was significant difference between the Group-A and Group-B in SPADI score and work performance score. The 't' test value was 4.811 with a p value < 0.05. Thus, there was a significant difference between the Group-A and Group-B in work performance.

DISCUSSION

The aim of this study is to find the effect of motor control exercise on shoulder pain and work performance among welders. Shoulder pain is the most common problem and it is highly susceptible to injury among welders. This demonstrates the study occupational significance. Welders are at a higher risk of shoulder injuries due to the repetitive and frequently awkward arm movements involved in welding.

In this study, shoulder pain is treated with motor control exercise with main focus on motor relearning, muscle strength, coordination and it also required significance level of neuromuscular control at all time and evaluated the 6 weeks motor control exercise training among welders and it showed significant difference in shoulder pain and function in post-intervention program among Group A.

The neurophysiological and biomechanical changes show the recovery mechanism with significant changes in the muscle recruitment. This explores the possible mechanics underlying the enhancements. It implies that the activities resulted in alterations in the neural system's regulation of muscle activation are known as neurophysiological alterations. Biomechanical alterations alterations in muscle recruitment patterns, indicating a healthier activation of the muscles around the shoulder joint.

The pain and reduced functional activities of welders in the pre intervention period are measured with SPADI questionnaire. The SPADI results changed drastically in post-intervention group attained the significant value. The work performance or task performance are rated by employer also improved statistically in Group A practiced with motor control exercises.

These results providing wide knowledge of intervention efficacy in welders with the complaint of shoulder Pain and reduction in work performance. This emphasizes the study's contribution to the existing body of knowledge regarding shoulder pain management in welders. **Roy J-S et al.,** (2009) has demonstrated that shoulder pain is reduced and their functional activities improved in participant who treated with motor control exercise. The study found the motor control exercise effectiveness and its improvement such as value of pain, function and individual work performance compared with shoulder free exercises welders. **Worsley et al.,** (2013) has concluded that 10-week treatment of scapular motor control training shows improvement in functional activities and increased scapular tilt posteriorly among shoulder impingement syndrome patients.

CONCLUSION

This study concluded that 6 weeks motor control exercise intervention for shoulder muscle is effective by reducing pain and disability and improving the work performance of welders.

LIMITATIONS

The relatively small sample size may limit the generalizability of the findings to a broader population of individuals with shoulder pain.

Participant selection criteria may have introduced selection bias, potentially excluding individuals with comorbidities or more severe shoulder pathologies.

The control group intervention may not have been a true 'placebo' potentially influencing the observed differences between groups.

RECOMMENDATIONS

Investigate the long-term effects of motor control exercise on shoulder pain and functional outcomes.

Explore the effectiveness of motor control exercise in specific subgroups of patients with shoulder pain (e.g., those with rotator cuff tears, impingement syndrome).

Compare the effectiveness of motor control exercise with other treatment modalities (e.g., manual therapy, injections, other exercise types)

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