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Comparative Effect of Motor Control Exercise Using Swiss Ball over Stretching Exercise on Mechanical Low Back Pain

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ABSTRACT

Background: Trunk muscle coordination can be improved by motor control exercise using Swiss ball exercises, trunk muscles that support the spine's stability and mobility. In this study effect of motor control exercise using Swiss ball is compared with stretching exercise on low back pain. This study is also aimed to find the effect of motor control exercise using Swiss ball and stretching exercise within the group on mechanical low back pain.

Methods: A Comparative study was done at ACS Medical College and Hospital, Chennai, with 30 samples. The duration of the treatment was four weeks. Male and female genders were selected for the study with the age of 18-25 yrs. The outcome measures were Low Back Index Scale, Quebec Disability Scale, and Schober Test. Total 30 subjects were randomly allocated, 15 in each group A and B by fulfilling inclusion criteria. Intervention for Group A trained with motor control exercise using Swiss ball and Group B with stretching exercise. Both groups receive treatment for three sessions /week of a total of 12 sessions of treatment.

Results: Motor Control Exercises using Swiss Ball found more effective than stretching on reduction of pain with mean difference 2.60 and 2.533 respectively, and stretching found more effective than motor control exercise on disability and improve spinal mobility with a mean difference of 19.00, 19.67, and 22.00, 23.00 respectively among patients mechanical low back pain.

Conclusion: Motor Control Exercises using Swiss Ball was found more effective than stretching to reduce pain, disability and improve spinal mobility among patients with mechanical low back pain.

Keywords: Swiss ball, Motor control exercise, Stretching exercise, Mechanical low back pain.

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INTRODUCTION

One of the common musculoskeletal disorders among people is Low back pain. This problem is mainly occupational-related wrong position adapted in a different posture. It affects the person both medically and socially correlates with other musculoskeletal pain [1,2].

The mechanical low back pain may affect people's daily activity. Back pain leads to less activity and reduced exercise, which reduces the strength of the back muscle. The weakness of spinal muscle is less spinal exercises that reduce the stability and mobility of the trunk. Back pain is increased due to reduced muscle strength, thereby difficult to maintain erected posture [3,4].

Non-specific back pain is due to mechanical stress related to the wrong posture and over strain of back muscles in response to excess work. The vertebral column is designed with strong bones, ligaments, and musculature, supplied by the good blood supply and nerve supply to regulate the joints' movements and stability [6,7].

Lower limb movements are associated with lower back and pelvic stability. Lower limb movements/activities, including sitting, bending, affect the lower back spine's compression and pelvic bone rotation related to stretching of ligaments and muscles. Overstretching of muscles, ligaments, and compression of vertebral joints induce low back pain [8].

Mechanical stress in the lower back can lead to mild pain or severe pain, and the pain may occur suddenly or slowly. Most commonly, lifting heavy objects can compress soft tissue around the lower back, leading to strain mechanical low back pain. Repeated intense muscle work and long-time movements of lower limbs in the same direction may induce soft tissue injury result in low back pain [9,10].

METHODOLOGY

A Comparative study was done at ACS Medical College and Hospital, Chennai, with 30 samples. The duration of the treatment was four weeks. Both male and female subjects were taken with age group between 18-25 yrs. The outcome measures were Low Back Index Scale, Quebec Disability Scale, and Schober Test. 30 subjects were randomly allocated, 15 in each group A and B by fulfilling inclusion criteria. Intervention for Group A with motor control exercise using Swiss ball and Group B with stretching exercise. Both groups receive treatment for three sessions /week. Total 12 sessions of treatment.

PROCEDURE

This study aimed to evaluate motor control exercises' efficiency using Swiss ball over-stretching exercises in patients with mechanical low back pain. The subjects are randomly selected based on selection criteria. The subjects were aged between 18 to 25 years. A total of 30 subjects (male and female) were selected and randomly allocated 15 in two study groups.

GROUP-A:

Group-A consists of 15 subjects; the subjects were received motor control exercise using Swiss ball such as;

Bridging: The patient was asked to lie supine lying on the floor with their heels on the Swiss ball and asked to slowly raise their hips and maintain their body straight from heels to the shoulders.

Superman position: In this position, the patient was asked to prone lie on the Swiss ball keeping arms stretched above their head. Subjects were asked to raise their right arm and left leg five to six inches above the ground, then hold it in the same position for three seconds later can relax to the old position, then the subjects were asked to repeat it with left arm and right leg.

Bilateral hip extension: The subjects were asked to do prone lie on the Swiss ball and asked to support both arms on the floor in front. The subjects were then asked to extend their hips later hold it for 5 seconds in the same position.

GROUP-B:

Group- B consists of 15 subjects received stretching exercise such as;

Knee to chest stretch: The subjects were asked to lie on their back keeping both leg straight, later asked to bend right knee towards their chest with the support from both hands and hold it for 1 to 3 minutes. The subjects were later asked to repeat it for left side knee bend with supported hand and hold for the same time. Subjects were instructed to avoid hip lifting during bending the knees.

Piriformis stretch: Asked the patient to maintain supine lying by keeping both knees in bend position with feet on the floor. Later they were asked to keep the right ankle on the left thigh, followed by the left thigh was pulled towards the chest with both hand supports. This was repeated for the other leg by stretching towards the chest with a maximum comfortable stretch of the piriformis muscle and maintains it for 1 to 3 minutes.

Sphinx stretch: The subjects were asked to lie prone with elbow and palm support. Then the subject was asked to extend their trunk by lifting their chest and head up maximum from the floor. Subjects were instructed to tighten back muscles, do deep breathing, press their pelvis to the floor and close their eyes. The subjects were asked to hold the position for 1 to 3 minutes.

Intervention: Intervention for Group A with motor control exercise using Swiss ball and Group B with stretching exercise. Both groups receive treatment for three sessions /week. Total 12 sessions of treatment. Before and after the completion of 4 weeks of intervention, data would be obtained from the subject.

Data analysis:

Group A- Motor Control Exercises using Swiss Ball

VAS	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	t	p- value	Sig. Diff. (P < 0.05)
Pre Test	5.800	15	2.60	0.5071	14	19.86	<0.0001	****
Post Test	3.200			0.1309				

Table 1: Paired t-test on VAS within Group A on the effectiveness on mechanical low back pain.

The above table 1 shows a significant difference in pain among patients with mechanical low back pain with a p-value >0.0001

Quebec disability scale	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	t	p- value	Sig. Diff. (P < 0.05)
Pre Test	64.00	15	19.00	3.381 0.8729	14	21.77	P>0.0001	****
Post Test	45.00							

Table 2: Paired t-test on Quebec disability scale within the Group A on disability among patients with mechanical low back pain.

Above table 2 shows a significant difference in disability effectiveness of patients with mechanical low back pain with a p-value >0.0001.

Schober test	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	t	P value	Sig. Diff. (P < 0.05)
Pre Test	68.33	15	22.00	3.162 0.8165	14	26.94	P> 0.0001	****
Post Test	46.33							

Table 3: Paired t-test on Schober test within Group A on the effectiveness of spinal mobility among patients with mechanical low back pain.

Above table 3 shows a significant difference in spinal mobility among patients with mechanical low back pain with a p-value >0.0001.

Group B -Stretching Exercise

VAS	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	T	P value	Sig. Diff. (P < 0.05)
Pre Test	5.800	15	2.533	0.5164 0.1333	14	19	P>0.0001	****
Post Test	3.267							

Table 4: Paired t-test on VAS within Group B on pain effectiveness among patients with mechanical low back pain.

The above table 4 shows a significant difference in VAS within Group B on the effectiveness on pain among patients with mechanical low back pain with p-value >0.0001.

Quebec disability scale	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	T	P value	Sig. Diff. (P < 0.05)
Pre Test	64.67	15	19.67	5.815 1.501	14	13.10	>0.0001	****
Post Test	45.00							

Table 5: Paired t-test on Quebec disability scale within Group B on effectiveness in disability among patients with mechanical low back pain.

Above table 5 shows a significant difference in the Quebec disability scale within Group B on the effectiveness of disability among patients with mechanical low back pain with a p-value >0.0001.

Scober test	Mean	Number of Pairs	Mean Diff.	SD, SEM	DF	T	P value	Sig. Diff. (P < 0.05)
Pre Test	66.67	15	23.00	5.916 1.528	14	15.06	>0.0001	****
Post Test	43.67							

Table 6: Paired t-test on Schober test within Group B on effectiveness in disability among patients with mechanical low back pain.

Above table 6 shows a significant difference in the Schober test within Group B on the effectiveness of spinal mobility among patients with mechanical low back pain with a p-value >0.0001.

Comparative Study between Group A and B (ANOVA)

Out come Measures	Exercise Group A and B	Test	Mean	Mean Diff.	R Square	F	p-value	Sig. diff. (P < 0.05)
VAS	Motor Control Exercises using Swiss Ball	Pre test	5.800	2.60	0.6913	41.81	<0.0001	****
		Post Test	3.200					
	Stretching Exercise	Pre test	5.800	2.53				
		Post Test	3.267					

Table 7: ANOVA to compare VAS between Group A and B is among patients with mechanical low back pain

Above table 7 shows a significant difference in VAS between Group A and B among patients with plantar fasciitis with a p-value <0.0001.

Out come Measures	Exercise Group A and B	Test	Mean	Mean Diff.	R Square	F	p-value	Sig. diff. (P < 0.05)
Quebec disability scale	Motor Control Exercises using Swiss Ball	Pre test	64.00	19.00	0.4757	16.94	<0.0001	****
		Post Test	45.00					
	Stretching Exercise	Pre test	64.67	19.67				
		Post Test	45.00					

Table 8: ANOVA to compare between Group A and B among patients with mechanical low back pain

Above table 8 shows a significant difference on the Quebec disability scale between Group A and B among patients with mechanical low back pain with a p-value <0.0001.

Out come Measures	Exercise Group A and B	Test	Mean	Mean Diff.	R Square	F	p-value	Sig. diff. (P < 0.05)
Scober test	Motor Control Exercises using Swiss Ball	Pre test	68.33	22.00	0.5465	22.49	<0.0001	****
		Post Test	46.33					
	Stretching Exercise	Pre test	66.67	23.00				
		Post Test	43.67					

Table 9: ANOVA to compare FFI between Group A and B among patients with mechanical low back pain

Above table 6 shows a significant difference on Schober between Group A and B among patients with mechanical low back pain with a p-value <0.0001.

RESULT

A total of 15 participants of both genders suffering mechanical low back pain was included in the study based on specific selection criteria with an age group between 19 to 24 years. In this study, the pain has reduced with a mean difference of 2.60, by Motor Control Exercises using Swiss Ball with P value>0.0001, among patients with mechanical low back pain. In the study, pain has reduced with a mean difference of 2.533 by Stretching Exercise with a p-value of 0.0001 among patients with mechanical low back pain. Spinal Disability has reduced with a mean difference of 19.00. Motor Control Exercises using Swiss Ball with a p-value > 0.0001 and spinal Disability has reduced with a mean difference of 19.67, Stretching Exercise with p-value >0.0001, among patients with mechanical low back pain. Spinal mobility has improved with a mean difference of 22.00. Motor Control Exercises using Swiss Ball with ap-value > 0.0001 and Spinal mobility has improved with a mean difference of 23.00, Stretching Exercise with ap-value >0.0001, among patients with mechanical low back pain.

A comparative study between Group A and Group B showed a significant difference in the effectiveness of pain, spinal disability, and spinal mobility with a p-value >0.0001. Motor Control Exercises using Swiss Ball found more effective than stretching on reduction of pain with mean difference 2.60 and 2.533 respectively, and stretching found more effective than motor control exercise on disability and improve spinal mobility with a mean difference of 19.00, 19.67, and 22.00, 23.00 respectively among patients mechanical low back pain.

DISCUSSION

Motor control can be increased by a coordination exercise program, which has been proved and reported in many studies. Coordination exercise for the spinal muscles can produce effective motor control on trunk muscles to reduce low back pain. Coordination exercise can improve optimal muscle control by a motor control learning approach on spinal muscles [11].

Lumbar spinal stability and mobility are important factors related to low back pain. Strong muscular control around the lumbar spine is necessary to maintain stability and function of the lower back. Dynamic stability and balance are required to prevent soft tissue damage around the lumbar spine. Swiss ball coordination exercise can improve motor control, increasing dynamic balance and flexibility in the lumbar spine. Coordination exercise can also improve muscle strength and endurance, which better functional mobility in the lower back spine. This exercise program thereby can reduce low back pain [12].

Spinal flexibility is strongly associated with muscular stretching in the lumbar spine, which can improve lumbar function. The tightness of soft tissues around the lumbar spine is related to mobility and joint structures, which increase low back pain. Regular warm-up exercises and spinal stretching can improve spinal flexibility and lumbar function. Strengthening of weak muscles and stretching of tight muscles can correct the posture by reducing soft tissue injuries and improving functional activity performance. Spinal disability can be reduced by regular stretching and exercise program, so low back pain can be prevented [13].

A study by rhythmic stabilization and Swiss ball exercise has reported an effect on low back pain. Delay on diagnosing LBA and not performing effective exercise program which leads musculoskeletal disorders into chronic status. Low back pain is one of the main reasons for disability around the lumbar spine to consider more functional loss and difficulty to normalize the lumbar function. The techniques mentioned above are more effective in reducing lumbar disability and improving lumbar function among subjects with non-specific low back pain [14].

A study on the effectiveness of stretching over placebo stretching has shown significant results in improving lumbar flexibility, function and reducing pain in community nurses with mechanical low back pain. Stretching with flexibility exercises has reported more effect on improving lumbar function and reducing low back pain [15].

Ethical Clearance: This study has obtained ethical clearance to conduct from the Faculty of Physiotherapy, DR.MGR. Educational and Research Institute, Chennai, with reference number: C-13/ PHSIO/IRB/2019-20 dated 07/01/2020.

Conflict of interest: There is no conflict of interest in conducting this study and publishing this article.

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CONCLUSION

Motor control exercises using Swiss ball more effective than stretching on reduction of pain with mean difference 2.60 and 2.533 respectively, and stretching found more effective than motor control exercise on disability and improve spinal mobility with a mean difference of 19.00, 19.67, 22.00, 23.00 respectively among patients mechanical low back pain.

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