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CORE STABILIZATION PROGRAM AND CONVENTIONAL EXERCISES IN THE PATIENTS WITH LOW BACK PAIN"– A COMPARATIVE STUDY

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ABSTRACT

Background: Conventional back care exercises are advocated to treat the pain and to strengthen the involved muscles. There will always be the possibility of the pain getting recurred due to disproportionate balance and stability in the muscles. The core stabilization is major trend in rehabilitation. It aims at improving stability during functional activities, balance, flexibility, strength training and effectively manage the pain as well.

Methods: Forty patients with chronic Mechanical Low back pain were randomly assigned into control group that received conventional back exercises and SWD (n=20), experimental group received core stabilization and SWD (n=20). Both the groups received SWD, along with conventional back exercises for one-group and core stabilization for the other group 3 days a week for 6 weeks .The treatment outcome was assessed using visual analogue scale, Rolland Morris Disability Questionnaire and Lumbar range of motion by using goniometer.

Results: After a 6 week training period the core stabilization group scored significantly higher than the conventional group for VAS ($p=0.05$) and RMDQ ($p=0.05$) where as ROM improved higher in conventional group ($p=0.05$)

Conclusion: After the treatment sessions Core stabilization group registered a significant improvement when compared to conventional back care exercises in improving function and in relieving pain.

Key words: core stabilization, conventional exercises, Mechanical low back pain, Physio ball, VAS, RMDQ, and ROM.

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INTRODUCTION

Low back pain is defined as the pain that occurs in an area with boundaries between the lowest rib and the crease of the buttocks.[1] Low backache is a discomfort in the area of the lower part of the back and spinal column.[2] Low back pain is associated with deconditioning of spine and trunk due to lack of core strength and stability in which 60- 80% of general population suffer with high recurrence rates of 60 – 85 % within following three years.[3] Chronic Low back pain is the pain that persists longer than the expected time period for healing, with a duration of more than three months.[4]

Most low back injuries are not the result of a single exposure to a high magnitude load, but instead due to cumulative trauma from sub-failure-magnitude loads like repeated small loads (e.g. bending) or a sustained load (e.g. sitting). Low back injury results from repetitive motion at end range as a result of a history of excessive loading which gradually, but progressively, reduces the tissue failure tolerance.[6]Mechanical low back pain is a cumulative process resulting from chronic poor posture coupled with sedentary habits that put the back under severe mechanical stress.[7]A wide range of conservative interventions has been advocated for the treatment of low back pain when it is chronically symptomatic. These interventions include orthotic bracing, flexion exercises, abdominal trunk curls, hamstring stretching, pelvic tilt exercises, and general aerobic exercise such as swimming and walking.[8]

These conventional back care exercises decrease the pain and increase the strength of involved muscles, but results in frequent recurrence rates because of their effectiveness only up to one year and patients are left out with some residual pain and disability.

The conventional back exercises strengthen the involved muscles like abdominals, which are ineffective after 45 degrees of trunk curls.[9] The human spine buckles invitro during a compressive load of 90 N but the spine is loaded of about 4000 – 6000 N, while administering various back extension exercises like prone lying and lifting one leg, alternate leg and arm lifts, lifting upper trunk and both legs off the floor.[10] The efficacy of general back exercises however, appears limited in achieving these goals.[11]

Lumbar instability is considered to be a significant factor in patients with chronic low back pain.[12] Spinal instability is described as a significant decrease in the capacity of the stabilizing systems of the spine to maintain the intervertebral neutral zones within physiological limits so that there is no neurological dysfunction, no major deformity, and no incapacitating pain.

A conceptual model of the spinal stabilization system was introduced by Punjabi, which describes the interaction between components providing stability in the spine. This model redefined the notion of spinal instability in terms of a region of laxity around the neutral resting position of a spinal segment, that he terms the 'neutral zone.'[13]

The large load-carrying capacity of the spine is achieved by the participation of well-coordinated muscles surrounding the spinal column. The role of multifidus, transverses abdominus, diaphragm and pelvic floor, as well as those muscles working across the pelvic region, play an integral role in the dynamic stability of the lumbar and lumbopelvic regions.[14]

A link has been established between dysfunction in the local muscle system and back pain, which has lead to a concept of therapeutic exercise to enhance lumbar and lumbopelvic stabilisation, based on the specific rehabilitation of both the global, and the local muscle system.[15]

A recent focus in the physiotherapy management of patients with CLBP has been the specific training of muscles surrounding the lumbar spine whose primary role is considered to be the provision of dynamic stability and segmental control to the spine40. These are the deep abdominal muscles (internal oblique) and transversus abdominis and the lumbar multifidus. The importance of LM muscle regarding its potential to provide dynamic control to the motion segment in its neutral zone is now well acknowledged.[16]

The deep abdominals, in particular the TA, are primarily involved in the maintenance of intraabdominal pressure, while imparting tension to the lumbar vertebrae through the thoracolumbar fascia.[17] It is considered that the role of the deep abdominal muscles acting in co-contraction with the LM is to provide a stiffening effect on the lumbar spine through its attachment to the thoracolumbar fascia, in conjunction with an increase in intraabdominal pressure. In addition, there is increasing evidence that these muscles are preferentially affected in the presence of low back pain and lumbar instability.[18]

The aims of core stability training is to effectively recruit the trunk musculature and then learn to control the position of the lumbar spine during dynamic movements.[19]

Core stabilization exercises facilitate co-contraction between abdominals and back extensors to maintain the spinal stability so as to transfer the loads equally and to make the patient functionally active. Swiss ball exercise can improve nervous system function that results in functional strength gain.[20] The abdominal hollowing exercises decrease the compressive loads on the spine by 40%.

Many recent studies have proved that spinal stabilization exercises are more effective than conventional back exercises in improving functional status and lessen the behavioral, cognitive and disability aspects of low back pain syndrome. But there are some conflicting reports that core strengthening is not significant to decrease the low back pain.[21]

Core stabilization is most effective on dynamic surfaces in order to recruit proprioceptive, kinesthetic and balance system.[22]

Though conventional back care exercises and core stabilization exercises are proved to be effective in chronic mechanical low back pain patients, no literature comparing the effectiveness on each other were found which necessitated the present study to compare the outcome of conventional and core stabilization exercises in chronic mechanical low back pain.

METHODOLOGY

40 subjects with age group between 30-50 years, Both male and female patients, Postural predisposition (both mechanical and occupational), were taken selected from the outpatient department of physiotherapy, patients with cardio –pulmonary diseases, tumor, infection and fracture, rheumatic and inflammatory condition, disc disease, Lumbar strain or spra, Lumbar canal stenosis, Bowel and bladder dysfunction were excluded, divided in two groups of 20 each selected randomly both male and female of age group 30-50 with the diagnosis of chronic mechanical low back pain. in two groups of 20 each selected randomly both male and female of age group 30-50 with the diagnosis of chronic mechanical low back pain, divided into two groups, Group A: Control group 20 patients, Group B: Experimental group 20 patients

Ethical Clearance was obtained from the concerned authorities of the institution.

Informed consent was taken from the patients prior to the evaluation and treatment sessions.

40 patients were randomly selected and equally divided into control and experimental groups of 20 each. An Orthopaedic evaluation was done prior to the study to rule out other causes of backache. Pain was measured on visual analog Scale and each patient was asked to fill the Rolland Morris low back pain and disability questionnaire.

Group A

Short wave diathermy was given for 15 minutes prior to starting the exercises to relieve pain.[51] The patients in the control group were treated with conventional back exercise program for 3 days a week for 6 weeks.

Exercise 1: supine lying – Leg lifts

The patient in supine lying was asked to lift one leg first and hold it for five seconds and return to neutral position and repeat the same for other leg. Later both the legs were made to lift simultaneously, holding them for five seconds and bringing them back to neutral position.

Exercise 2: Abdominal crunches in crook lying position

The patient in crook lying was asked to place the hands behind the head and lift the trunk upwards, rotate to either side to reach the knees and hold the position for five seconds then bring them back to neutral position.

Exercise 3: Prone lying – Leg lifts

The patient in prone lying was asked to lift one leg first and hold it for five seconds then bring it to neutral position and repeat the same for other leg. Later made to lift both the legs simultaneously, hold them for five seconds, and then bring them back to neutral position.

Exercise 4: Prone lying – Trunk lifts

The patient in prone lying was asked to keep the hands along the side of the body, lift the trunk off the floor and hold the position for five seconds, then bringing it back to neutral position.

*Each of these exercises was given for ten repetitions per session.

Group B:

Short wave Diathermy was given for 15 min before the exercise session to relieve pain. Patients in experimental group were treated with core stabilization exercises for 30 min of 10 repetitions each with 10 sec hold and adequate rest was given between each repetition. The training session was scheduled for 3 days a week for 6 weeks.

The Exercises given were as follows:

Exercise 1:

Patient in supine lying on physio ball was instructed to place the hands behind the head and lift the trunk to reach the knees to hold the position for five seconds then bring it back to neutral position. Balancing one hip on the ball with legs out, arms crossed on the chest to perform side crunches and repeat the same on the other side.

Exercise 2:
Patient lying on his back with calves resting on the ball was asked to rock very slowly side-to-side with normal breathing.

Exercise 3:
The patient in supine lying on the floor with feet on the ball and ankles together, arms behind the buttocks, using the thigh and abdominals asked to straighten the legs and hold it for 10 seconds then bring them back to neutral position.

Exercise 4:
The patient in prone lying on physio ball was asked to lift one leg and contralateral arm, d hold it for 10 seconds, bring them back to neutral position.

*Each of these exercises was given for ten repetitions per session.

After 6 weeks of training program, the patients were reassessed on the basis of pain rating on VAS and disability rating on the Rolland Morris Disability Questionnaire and ROM by using Goniometer.

STASTISTICAL ANALYSIS

A group of 40 patients were randomly assigned into two groups of 20 in each (n = 20) into Control group (n = 20), Experimental group (n = 20), which were analyzed for their normality and homogeneity by using one-way ANOVA. This analysis has shown that all the groups were homogeneous and hence were analyzed for their significance by using independent t- test. This analysis has shown significance in relation to decrease in pain, improving the functional outcome and disability at p = 0.05 in core stabilization group when compared to control group.

RESULTS

The following is the statistical analysis done in this study:
A total of 40 patients (n = 40) were randomly assigned to Group-A (n = 20) and Group-B (n = 20).

The data collected were analyzed for the following outcome measures as variables.

1. Rolland Morris Disability Questionnaire
2. Visual Analogue Scale
3. Lumbar Range of motion

All these variables were tested for normality of data using graphical analysis.
It was further evaluated for consistency of data

Rolland Morris Disability Questionnaire

Table-1: Test for Homogeneity of Pre-test variables for RMDQ scale

	Sum of Squares	Df	Mean Square	F	Sig.	Std. deviation	t-value	P value
Between Groups	27.950	6	4.658	1.433	.275	1.394538	2.308	0.05
Within Groups	42.250	13	3.250			6.734827		
Total	70.200	19						

The homogeneity of the data in the two groups was analyzed by using one-way ANOVA, which showed that the significance was greater than p = 0.05 and hence both the groups were homogenous, for pre-test RMDQ scores.

VAS GROUP

Table-2: Test for Homogeneity of Pre-test variables for VAS scale

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	9.583	4	2.396	2.331	.103	0.933	4.098	0.05
Within Groups	15.417	15	1.028			0.994		
Total	25.000	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p = 0.05 and hence the data are considered homogenous for VAS scores.

RANGE OF MOTION

FLEXION GROUP

Table -3: Test for Homogeneity of Pre-test variables for Flexion Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	41.783	6	6.964	1.541	.241	3.704	0.293	0.05
Within Groups	58.767	13	4.521			2.673		
Total	100.550	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Flexion Group.

EXTENSION GROUP

Table-4: Test for Homogeneity of Pre-test variables for Extension Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	45.217	8	5.652	.539	.805	3.281	0.855	0.05
Within Groups	115.333	11	10.485			3.726		
Total	160.550	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Extension Group.

RIGHT SIDE FLEXION GROUP

Table-5: Test for Homogeneity of Pre-test variables for Right Side Flexion Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	33.786	6	5.631	.725	.638	2.384	1.186	0.05
Within Groups	101.014	13	7.770			2.723		
Total	134.800	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Right Side flexion Group.

LEFT SIDE FLEXION GROUP

Table-6: Test for Homogeneity of Pre-test variables for Left Side Flexion Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	42.500	7	6.071	1.844	.168	3.747	1.173	0.05
Within Groups	39.500	12	3.292			9.218		
Total	82.000	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Left Side Flexion Group.

RIGHT ROTATION GROUP

Table-7: Test for Homogeneity of Pre-test variables for Right Rotation Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	53.000	7	7.571	1.284	.335	3.883	1.173	0.05
Within Groups	70.750	12	5.896			4.773		
Total	123.750	19						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Right Rotation Group.

LEFT ROTATION GROUP

Table-8: Test for Homogeneity of Pre-test variables for Left Rotation Group

	Sum of Squares	df	Mean Square	F	Sig.	Std. Deviation	t-value	P value
Between Groups	35.943	9	3.994	.415	.901	2.874	2.067	0.05
Within Groups	105.867	11	9.624			4.193		
Total	141.810	20						

The data collected was analyzed for homogeneity between the groups and within the groups using ANOVA table holding control group as the defining variable.

It was shown that all the values calculated had a significance greater than p=0.05 and hence the data are considered homogenous for Left Rotation Group.

Note: The ANOVA table gives the F-values for significance of variance and as all the values have significance greater than 0.05 hence the groups are considered homogenous.

Data Analysis for significance of improvements between the groups

Group- A data analysis

The data showed that the mean improvements in conventional training group is 5.35 ± 0.933 for VAS scale, 10.55 ±1.395 for RMDQ, 15.4±3.704 for flexion, 16.85±3.281 for extension, 22±2.384 for Right side flexion, 24.4±3.747 for Lt side flexion, 25.7±3.883 for Right rotation, 26.05±2.875 for Lt rotation. This clearly indicates that all the patients in this group have showed improvements in all the three categories of outcome measures.

Group- B data analysis

The data in this group of patients showed mean improvements in all categories with VAS improvements being 6.6± 0.995, for RMDQ 14.1± 6.735, 15.1± 2.673 for flexion, 15.9± 3.726 for extension, 21.05± 2.723 for Right side flexion, 22.85± 9.218 for Lt Side flexion, 24.45± 4.773 for Right rotation, 23.7± 4.193 for Lt rotation.

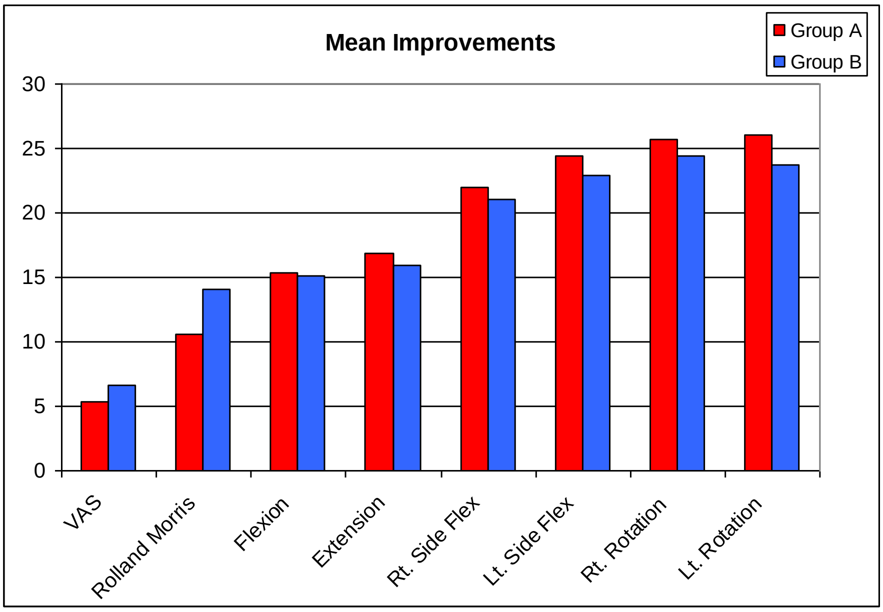
Analysis of significance of improvement between Conventional group and Core strengthening group: The mean improvements between the two groups of low back pain patients were tested for significance using student t- test. The calculated t-values for the VAS scale was significant at p=0.05 and RMDQ showed a significant variation at p=0.05 and the ROM values also are significant at p=0.05.This analysis shows that both the groups have shown improvements with the treatment given, but the mean improvement in the group that received core strengthening is higher when compared to the group that received conventional exercise program. This clearly indicates that core-strengthening program is more effective than conventional program.

The calculated p value showed a significance of difference in improvement at p=0.05, which indicates that conventional group has higher gains in improvement in left rotation than the Core strengthening group.

Table-9: Mean Improvements between the Groups

Parameter	Group A		Group B		t-Values
	Mean	S.D	Mean	S.D	
VAS	5.35	0.933	6.6	0.995	4.0983
Rolland Morris	10.55	1.395	14.1	6.735	2.308
Flexion	15.4	3.704	15.1	2.673	0.2936
Extension	16.85	3.281	15.9	3.726	0.855
Rt. Side Flex	22	2.384	21.05	2.723	1.173
Lt. Side Flex	24.4	3.747	22.85	9.218	0.696
Rt. Rotation	25.7	3.883	24.45	4.773	0.872
Lt. Rotation	26.05	2.875	23.7	4.193	2.067

Figure-1: Mean Improvements



DISCUSSION

This study is done on 20 patients in each group, with 11 males and 9 females in conventional group and 11 males and 9 females in core stabilization group.

The patients in group A showed improvements in VAS score with a mean of 5.35 and in Rolland Morris Disability Questionnaire with a mean of 10.55. These patients also shown improvements in flexion, extension, side flexion and rotation at p=0.05.

The patients in Group B also showed improvements in VAS scores with a mean of 6.6 and Rolland Morris Disability Questionnaire with a mean of 14.1. These patients also shown improvements in flexion, extension, side flexion and rotation at p=0.05.

In case of Group A improvements in ROM is slightly higher than that of Group B, this could be attributed to the reason that in Group A, the concentration is on strengthening the isolated muscles, where as in group B the concentration is on strengthening the group muscles.

Though conventional back care exercises and core stabilization exercises are proved to be effective in chronic mechanical low back pain patients, the group that received core stabilization exercises shown more improvements in VAS with significance at p=0.05.

This is in accordance to the Mc Gill's study that performing exercises on labile surfaces increased abdominal muscle activity, which changes both the level of muscle activity and the way that the muscles co- activate to stabilize the spine and the whole body. This suggests a much higher demand on motor control system, which may be desirable for rehabilitation program.

Group B patients showed improvements in their disability levels measured by Rolland Morris Disability Questionnaire as core stabilization creates a "girdle" of protection for the low back that challenge balance, postural trunk muscles, flexibility and coordination.

The results of this study support the initial hypothesis that specific exercise training of the "stability" muscles of the trunk is effective in reducing pain and functional disability in patients with chronically symptomatic low back pain. Analysis of the pain and functional disability revealed that there is a difference in improvements between both the groups. This treatment approach was more effective than other conservative treatment approaches which mainly involved conventional exercise programs.

This is in support of Punjabi's hypothesis that the stability of the lumbar spine is dependent not solely on the basic morphology of the spine, but also the correct functioning of the neuromuscular system. Therefore, if the basic morphology of the lumbar spine is compromised, as in the case with symptomatic CLBP, the neuromuscular system may be trained to compensate, to provide dynamic stability to the spine during the demands of daily living.

Consistent with these findings, McGill reported that lumbar stability is maintained in vivo by increasing the activity (stiffness) of the lumbar segmental muscles, and highlighted the importance of motor control to coordinate muscle recruitment between large trunk muscles and small intrinsic muscles during functional activities, to ensure stability is maintained.

The other advantages of core stability strengthening program is that, they apart from improving core strength and stability also improved flexibility, posture, ease of movement, heightened body awareness, balance and coordination

CONCLUSION

Supporting evidence from the literature though seems to be controversial in certain areas, the out come of this study with highly significant statistical changes will lead us to the conclusion of accepting the research hypothesis which could be stated as "Core stabilization program is more effective in the management of chronic mechanical low back pain than conventional exercises".

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