

ORIGINAL RESEARCH

IJPHY

EFFECTS OF CORE STABILIZATION PROGRAM AND CONVENTIONAL EXERCISES IN THE MANAGEMENT OF PATIENTS WITH CHRONIC MECHANICAL LOW BACK PAIN

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ABSTRACT

Background: Conventional back care exercises are advocated to treat the pain and to strengthen the involved muscles. There will be 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.

Objective: To find the efficacy of the concept of core stabilization when compared to conventional back care exercises in patients with chronic mechanical low back pain.

Methods: Forty patients with chronic Mechanical Low back pain were selected through purposive sampling and were randomly assigned into control group who received conventional back exercises and SWD (n = 20), experimental group who 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 three days a week for 6 weeks. The treatment outcome was assessed using visual analogue scale, Rolland Morris Disability Questionnaire and Lumbar range of motion using goniometer.

Results: After a 6 weeks training period the core stabilization group scored significantly higher than the conventional group for VAS (p=0.05) RMDQ (p=0.05) whereas 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, Visual Analogue Scale, Rolland Morris Disability Questionnaire and Range of Motion.

Received 12th March 2015, revised 03rd April 2015, accepted 07th April 2015



www.ijphy.org

DOI: 10.15621/ijphy/2015/v2i2/65256

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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 back ache is the discomfort in the area of lower part of back and spinal column.² 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 The natural course of most low back pain is of self-limiting in nature, with vast majority of individuals improving within six weeks or less. Chronic low back ache is the persistence of pain more than the expected time of healing with a duration of more than three months.⁴ But only one third of population have reported that back pain gets relieved in less than a month, whereas another third reported that pain lasted for one to five months, and the remaining third reported that pain lasted for more than six months.⁵

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.¹³ 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 stabilization, 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 spine.¹⁶ 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, 17}

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.¹⁸ 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.^{19,20,21} 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.²² 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.²³ 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.²⁴

Core stabilization is most effective on dynamic surfaces in order to recruit Proprioceptive, kinesthetic and balance system.²⁵ 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. The aims of this study were to study the effect of conventional exercise program in patients with chronic mechanical low back pain, to study the effect of core stabilization in patients with chronic mechanical low back pain, to compare of the effects of the conventional exercise program and core stabilization and analyze for any significant variation.

METHODOLOGY

The subjects were taken selected from the outpatient department of physiotherapy, ESIC model hospital, Rajajinagar and from Mallige medical center, shivananda circle. The data was collected through purposive sampling based on inclusion and exclusion criteria and a total of 40 patients were randomly assigned into two groups of 20 each both male and female of age group 30-50 with the diagnosis of chronic mechanical low back pain. Pretest Posttest control group design of Randomized Clinical Trial was selected as research design. The inclusion criterion was both male and female patients, Age group between 30-50 years, Postural predisposition (both mechanical and occupational). Patients with cardio -pulmonary

diseases, tumor, infection and fracture, Rheumatic and inflammatory condition, disc disease, Lumbar strain or sprain, Lumbar canal stenosis, Bowel and bladder dysfunction, Patients with any known pathological lesion in spine were excluded.

PROCEDURE

The subjects who have met inclusion criteria were assessed for their physical findings. 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. An Orthopedics evaluation was done prior to the study to rule out other causes of backache. Lumbar ranges of motion were measured by using Goniometer. Pain was measured on visual analog Scale and each patient was asked to fill the Rolland Morris low back pain and disability questionnaire.^{26,27}

Intervention for Group A

Short wave diathermy was given for 15 minutes prior to starting the exercises to relieve pain.²⁸ The patients in the control group were treated with conventional back exercise program for 3 days a week for 6 weeks^{29,30}.

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.

Intervention for 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 weeks³¹

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 contra lateral arm and 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.

STATISTICAL 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 student 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 demographic presentation of the patients:

The Group- A had a mean age of 39.30 with standard deviation of 8.72. Group- B patients had a mean age of 39.05 with Standard deviation of 6.07. There were a total of 22 males and 18 females in all the groups. 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 all the outcomes measured



Figure -1: TREATMENT WITH SHORT WAVE DIATHERMY

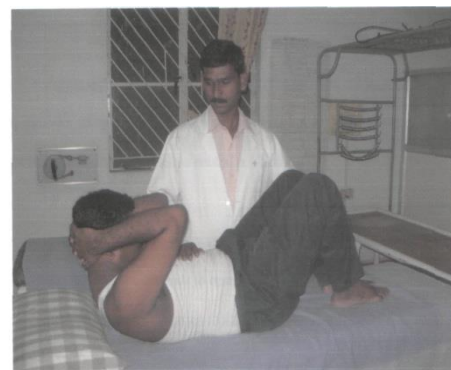


Figure -2: TREATMENT WITH CONVENTIONAL BACK EXERCISES

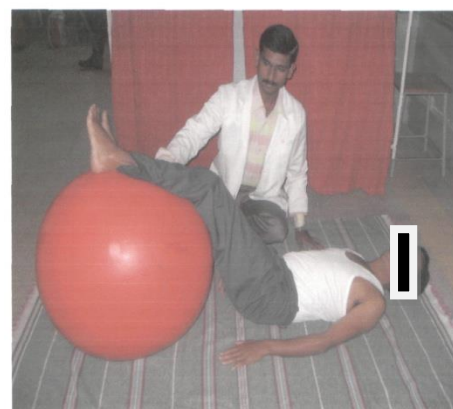


Figure - 3: TREATMENT WITH CORE STABILIZATION EXERCISE

Data Analysis for significance of improvements between the groups

Group- A (conventional group) 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 (core stability exercises group) 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 pain perception and RMDQ in the group that received core strengthening is higher when compared to the group that received conventional exercise program. But all ranges of motions were improved in conventional group when compared to core stabilization group..

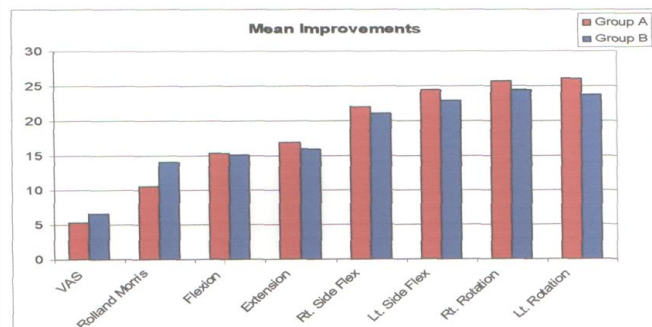


Figure-4: comparison of Mean improvements in all outcomes

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

Table-01: Mean Improvements between the Groups

DISCUSSION

This study is done on 20 patients in each group, with 11 males and 9 females in both the groups. Group A is conventional group and B is experimental group which received conventional back exercises and core stability exercises respectively.

The patients in Group A showed improvement in VAS score with a mean of 5.35 and in Rolland Morris Disability Questionnaire with a mean of 10.55 when compared with their baseline values. These patients also shown improvements in flexion, extension, side flexion and rotation with $p=0.05$.

The patients in Group B also showed improvements but slightly higher in VAS scores with a mean of 6.6 and Rolland Morris Disability

Questionnaire with a mean of 14.1 when compared with their baseline values and the conventional group too. These patients also shown improvements in flexion, extension, side flexion and rotation with $p=0.05$.

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.

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 McGill'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. In patients with chronic low back pain physiotherapy should also concentrate on training neural mechanisms are important thing. According to Punjabi's hypothesis the stability of lumbar spine is not only depending on morphology of the spine, but also the proper neuromuscular system functioning.^{32,33} Lumbar stability is maintained by activity of segmental muscles and coordination of large trunk muscles and small intrinsic muscles during functional activities³⁴. The other advantage of core stability program is that it can improve ease of movement, flexibility, heightened body awareness, balance and coordination.

The main limitation of this study may be its small size of sample. Even though the number of patients with back pain is increasing now a day the incidence due to mechanical cause can't be isolated due to co existence of other problems. The study duration is also a constraint in determining the long term effects of the interventions as the main issue of concern in low back pain is its recurrence. The study can be replicated by a large sample and prolonged duration in order to substantiate the post treatment effects and to generalize the results. The study can also include outcome measures documenting lumbar muscle strength. The intervention of core stability training should be carried out on different liable surfaces, and the dosage parameters like intensity and duration of intervention are to be given special attention.

CONCLUSION

Supporting evidence from the literature though seems to be controversial in certain areas; the outcome 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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Citation

Suresh Babu Reddy .A, Einstein Jerome, Sai Kumar. N. EFFECTS OF CORE STABILIZATION PROGRAM AND CONVENTIONAL EXERCISES IN THE MANAGEMENT OF PATIENTS WITH CHRONIC MECHANICAL LOW BACK PAIN. *International Journal of Physiotherapy*, 2(2), 441-447.