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EFFECT OF CONVENTIONAL EXERCISE PROGRAM VERSUS CORE STABILIZATION IN PATIENTS WITH CHRONIC MECHANICAL LOW BACK PAIN

Dr. Sumit Asthana[1], Dr. Arif Rizvi[2]

[1]Associate Professor & Head, E.I.A.H.Sc. & R, Era University, Lucknow
[2]Assistant Professor, E.I.A.H.Sc .& R, Era University, Lucknow

Conflicts of Interest: Nil
Corresponding author: Dr. Sumit Asthana

ABSTRACT

Objective: Effect of conventional exercise program versus core stabilization in patients with chronic mechanical low back pain

Background 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. It is one of the most common complaints of working-age popultion. 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

Study design: Experimental, Randomized Clinical Trial (Pretest Posttest control group design)

Methods: SUBJECTS; 30 patients were randomly selected and equally divided into control and experimental groups of 15 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. Common components of the two programs included a warm up period (stationary cycling and stretching exercises for a total of 10 – 15 minutes).

Results: A total of 30 subjects were recruited for the study, comprising 15 in two groups, group A and group B. group A was treated with conventional exercise program and group B with a core training program. The population comprised of 18 males and 12 females, with 9 males and 6 females in each group. The VAS score at the base line had a mean of 6.87 $\pm$ 1.51 for group A and 7.47 $\pm$ 1.19 for group B. Post intervention the mean scores of VAS for group A and B were 2.87 $\pm$ 1.30 and 2.73 $\pm$ 1.03 respectively. There was a significant within group difference between the scores of VAS at the baseline and post intervention for both groups A ($p = .001$) and group B ($p = .001$). However, the data analyses did not reveal any significant difference between the groups post intervention ($p = .87$). At the baseline the scores of VAS did not show any significant difference between the 2 groups ($p = .30$).

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".

Keywords: *low back pain, core muscle, stabilization, stretching exercise, conventional exercise.*

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] It is one of the most common complaint of working-age popultion.[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]

It is one of the most disabling factors often preventing sports person for participation in sporting activities.[4] In United States, the workers compensation claims account for about one fourth of all claims and one third of total compensation costs. It results in about 40% of absences from work.[5] In total spinal pain cases low back pain accounts for 60-70%.[6] 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.[7]

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. 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.[8]

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.[9]

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. It is aching in nature and typically worse toward the end of the day and better with rest.[10] 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. These conventional back care exercises decrease the pain and increase the strength of involves 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. The human spine buckles in vitro 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, alternative leg and arm lifts, lifting upper trunk and both legs off the floor. 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 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 spine40. These are the deep abdominal muscles (internal oblique) and transversus adbdominis 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 intra-abdominal 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 intra-abdominal 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]

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. Training of core muscles like transverse abdominis and lumbar Multifidus muscles is believed to be an important component in the rehabilitation of the patients with low back pain.[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 the chronic mechanical low back pain.

Methods

Participants:

Total of 30 patients in two groups of 15 each selected randomly both male and female of age group 25-35 with the diagnosis of chronic mechanical low back pain.

Group A: Control group 15 patients

Group B: Experimental group 15 patients

Inclusion criteria

1. Both male and female patients
2. Age group between 25-35 years
3. Subjects with back ache more than 6 months duration.

Exclusion criteria

1. Patients with cardio-pulmonary diseases
2. Patients with any traumatic onset of back ache.
3. Patients with rheumatic and inflammatory condition
4 Patients with any known infectious or metabolic lesion of spine.
5. Patients with disc disease.
6. Lumbar canal stenosis.
7. Bowel and bladder dysfunction.
8. Spinal Surgery.

Variables:

The Independent variables were conventional exercise program versus core stabilization in patients with chronic mechanical low back pain" and the dependent variables were pain and ROM.

Outcome measures:

Primary outcome measures were pain (measured using numeric pain rating scale) and ROM measured by universal goniometer.

Study Protocol

In this study we are comparing the effect of core stabilization program and conventional program in treating chronic mechanical low back pain. 30 individuals were randomly assigned into two treatment groups of conventional training and core stabilization program. Treatment effects were established by pre-post treatment assessment of VAS scale, RMDQ scale.

Procedure

Selections of patient are done through detailed assessment of physical findings, inclusion and exclusion criteria. Informed consent was taken from the patients prior to the evaluation and treatment session.

30 patients were randomly selected and equally divided into control and experimental groups of 15 each. An Orthopaedic evaluation was done prior to the s2tudy 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.[37,38] Common components of the two programs included a warm up period (stationary cycling and stretching exercises for a total of 10 – 15 minutes).

Group A

The patients in the control group were treated with conventional back exercise program for 3 days a week for 8 weeks.[7,24,26]

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

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 8 weeks.[24,26] The Exercises given were as follows :

Exercise 1:

These exercises were given for 1^{st} 2 weeks. The exercises comprised of low load activation of the local stabilizing muscles and progressively the holding time and number of contraction were increased. The correct activation of transverse abdominis was stressed and taught by abdominal drawing in maneuver. For correct activation of transverse abdominis and maintenance of lumbar position and pressure biofeedback was used.

Exercise 2:

Once a correct activation of muscles was achieved, and the subject could comfortably perform 10 contractions for 10 sec. duration each, integration with dynamic functions (activities that required spinal or limb movements) was stressed.

Exercise 3:

Stabilization exercises. These included curl up, side bridges and bird dog exercises. These exercises were made to progress from 4 point kneeling to 3 point to 2 point kneeling.

Exercise 4:

Physio ball exercises.These included balancing exercise while seated, abdominal crunches, modified push ups, pelvic bridging.

After 8 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.

Results

A total of 30 subjects were recruited for the study, comprising 15 in two groups, group A and group B. group A was treated with conventional exercise program and group B with a core training program. The population comprised of 18 males and 12 females, with 9 males and 6 females in each group.

The demographics of the subjects were age 30.80 ± 3.69 years for group A and 29.73 ± 3.86 years for group B (fig 5.1). Height was 172.8 ± 4.92 cms for group A and 172.40 ± 4.70 cms for group B (fig. 5.2) and weight was found to be 67.27 ± .5.65 Kgs. For group A and 70.13 ± 4.32 Kgs. for group B (fig.5.3). There was no significant difference between the groups for age (p = .53).

Table 5.1: Mean Of Demographics For Both Groups

	Group A	Group B
Age	30.80 + 3.69	29.73 + 3.86
Weight	62.27 + 5.65	70.13 + 4.32
Height	172.80 + 4.92	172.40 + 4.70

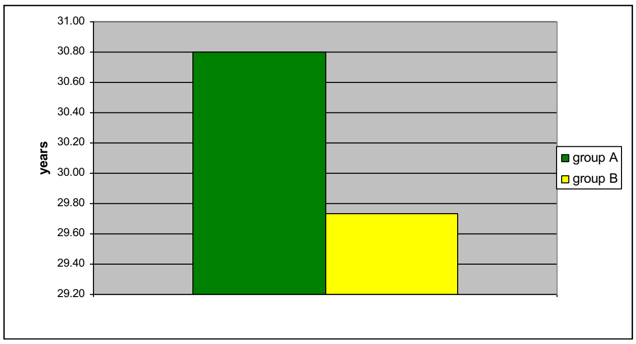

Figure 5.1: Comparison of mean age between the groups

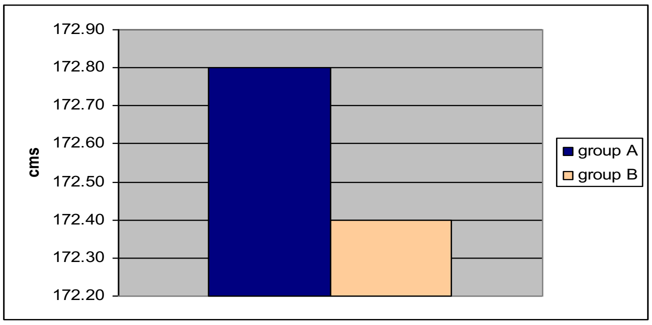

Figure 5.2: Comparison of height between the groups

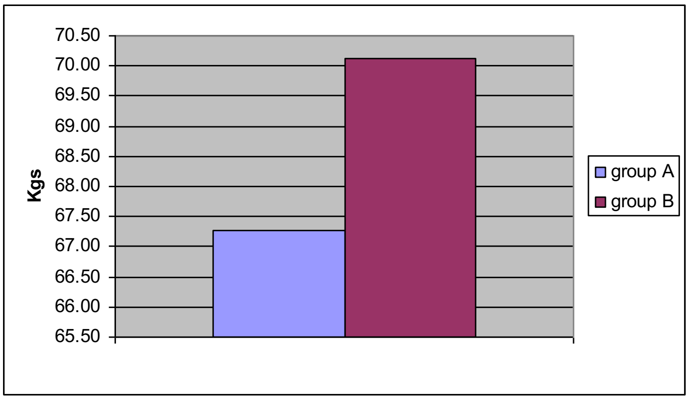

Figure 5.3: Comparison of weight between the groups

The subjects were assessed with the outcome measures at the baseline and after 8 weeks of intervention. The VAS score at the base line had a mean of 6.87 ± 1.51 for group A and 7.47 ± 1.19 for group B. Post intervention the mean scores of VAS for group A and B were 2.87 ± 1.30 and 2.73 ± 1.03 respectively (fig. 5.4).

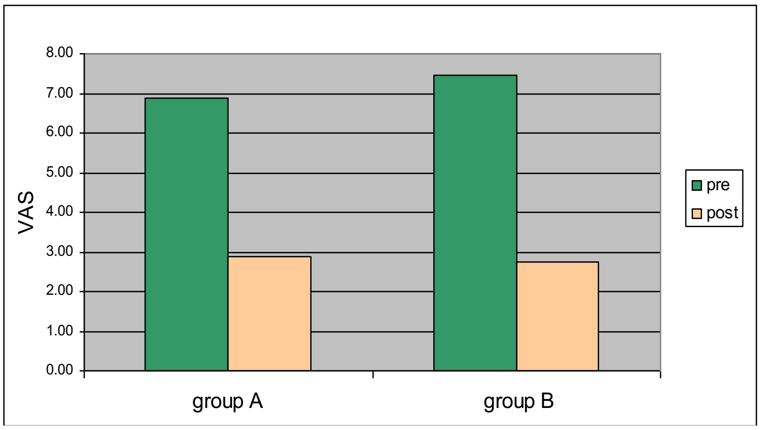

Figure 5.4: Comparison of VAS scores

At the baseline the scores of VAS did not show any significant difference between the 2 groups (p = .30). There was a significant within group difference between the scores of VAS at the baseline and post intervention for both groups A (p = .001) and group B (p = .001). However, the data analyses did not reveal any significant difference between the groups post intervention (p = .87).

Table 5.2: Mean Scores for VAS And RMDQ At Baseline And After Intervention

	VAS		RMDQ	
	Baseline	8 Weeks	Baseline	8 Weeks
Group A	6.87 + 1.51	2.87 + 1.30	15.67 + 1.80	5.73 + 1.83
Group B	7.47 + 1.19	2.73 + 1.03	16.27 + 1.16	2.73 + 0.88

For RMD questionnaire the baseline scores again did not show any significant difference between the 2 groups (p = .41). There was a significant within group difference between the pre intervention and post intervention scores for both groups (p = .001 for both group A and B).
There difference between the 2 groups for RMDQ was highly significant post intervention (p = .00).

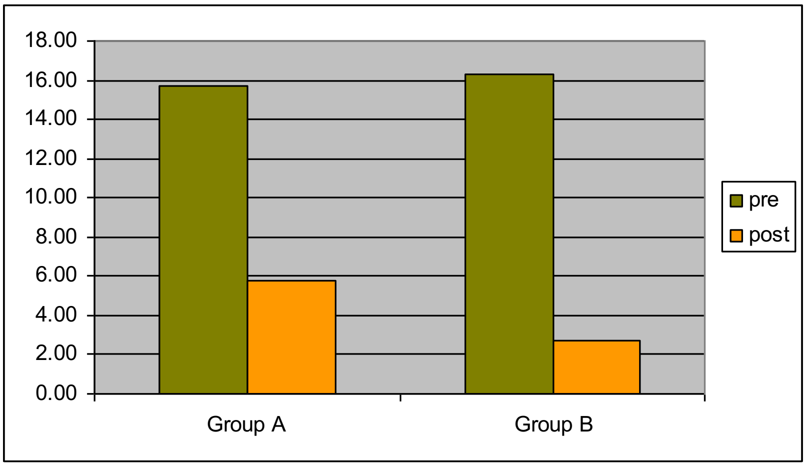

Figure 5.5: Comparison of RMDQ scores

Discussion

At the baseline we found no significant difference between the groups for age, VAS and RMD questionnaire. This shows that the two groups had similar values for the above said parameters. The training was administered for 8 weeks for both the groups A and B. Post intervention i.e. at 8th week the VAS score showed a significant improvement with training for both groups, i.e general strengthening and core training program. The results thus imply that both types of intervention are useful enough to reduce the pain perception by chronic low back ache patients.

Our results are in accordance with earlier performed studies.[6,7,14,24,28] The reasons for improvement in pain perception could be due the fact that as with strengthening of trunk muscles, both global and core, the load bearing capacity of muscles is enhanced. In mechanical low back patients pain could be largely caused because of increased external loads on non contractile elements of spinal column i.e. ligaments, joint capsules etc. As the mechanical behavior of contractile elements is improved with training the pain producing and sensitized elements of spine are rendered free of external load leading to improvement in pain with activities.

The disability levels also showed a significant improvement with both general and core strengthening program as shown by RMD questionnaire improvement pre and post intervention. However, the disability levels improved to a greater extent with core stabilization than with that of general strengthening intervention. The difference showed a statistical significance, wherein core stabilization was shown to be superior to that of general strengthening in reducing the disability levels.

The general strengthening program aimed at strengthening of global musculature of trunk i.e. muscles needed to perform activities like bending and turning. With training and strengthening of these muscles for 8 weeks would lead to improved capacity of these muscles to work under conditions of different load and for longer duration of time. Thus enabling a patient to work for longer time, without any abnormal biomechanical movement that could lead to pain perception or reduced capacity to work. Moreover, reduced fatigability and increased endurance of these muscles as a result of training could result in better absorption of external forces and better work capacity.

The core stability program aimed at core muscles of trunk in contrast to those of global muscles in general strengthening program. Core muscles comprise of small muscles that lie in close proximity to the axis of the spine e.g. multifidus, and those muscles that increase the segmental stability of the spine e.g. transverse abdominis. It has been established that in large number of cases the cause of back ache and disability is largely due to segmental instability.[13] Trunk muscles recruitment patterns in patients with low back pain have seen to be different from those in healthy subjects.[28] These differences are likely to be functional with respect to enhancement of spinal stability in the patients.

Based on the concept that specific muscles are able to stabilize the lumbar spine segmental stabilization exercise regimen was developed. The role of specific deep muscles such as transverse abdominis and multifidus in stabilizing the lumbar spine was highlighted.[7]

Our findings support the Punjabi's hypothesis that the stability of lumbar spine is dependent not solely on the basic morphology of spine, but also the correct functioning of the neuromuscular system.[14] The neuromuscular system may be trained to compensate and 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 co-ordinate muscle recruitment between large trunk muscles and small intrinsic muscles during functional activities, to ensure stability is maintained.[14]

Various studies[6,7,14] have provided high quality evidence that demonstrates the effectiveness of segmental stabilization exercises in pain reduction and functional improvement in chronic low back pain. In addition the authors demonstrated the long term effect which may be a significant positive factor for the segmental stabilization exercise At the baseline we found no significant difference between the groups for age, VAS and RMD questionnaire. This shows that the two groups had similar values for the above said parameters.

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Limitations of Study

1. The sample size in this study is small. The findings should be substantiated in a larger group of subjects.
2. The importance of the factors to treatment outcome in chronic mechanical low back patients is not verified in this study.
3. The follow-up to see the long-term effects of training is not done.
4. The study has not taken into consideration of the patients other than the chronic mechanical low back pain patients who constitute a fewer percentage of total back pain patients.
5. The results of the study cannot be generalized to all unstable surface and all strength-training exercises.
6. Improvements in strength of lumbar stabilizing muscles have not been documented.

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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