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ORIGINAL ARTICLE

COMPARATIVE STUDY ON LUMBAR STABILIZATION AND DYNAMIC LUMBAR STRENGTHENING EXERCISES IN REDUCING PAIN AND DISABILITY FOR PATIENTS WITH CHRONIC LOW BACK PAIN: EXPERIMENTAL STUDY

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ABSTRACT

Background of the study: Low back pain (LBP) affects 60-80% of people at some time in their lives. It is a cause of physical morbidity and disability[2]. The management of low back pain includes a wide range of intervention strategies including surgery, drug therapy, and nonmedical intervention like rehabilitation. Exercise therapy is proven to be effective in decreasing pain and improving function in chronic low back pain patients.[8] Objective of the study was to compare the effectiveness of lumbar stabilization and dynamic lumbar strengthening exercises for reducing pain and disability in patients with chronic low back pain. **Methodology**: Total 30 patients were recruited and assigned into two groups (15 patients in each group). Group A was treated with lumbar stabilization exercises and Group B was treated with dynamic lumbar strengthening exercises. Each group exercise session lasted for 60min and was performed 3 days/week for 8 weeks. Visual analogue scale (VAS) and Oswestry disability index (ODI) were used for pre and post treatment assessment. **Result:** The VAS and ODI were significantly reduced in both groups. In the intergroup comparison Group A (lumbar stabilization) show significantly greater improvement in all outcome than Group B (dynamic lumbar strengthening). **Conclusion:** Lumbar stabilization exercises are more effective than the lumbar dynamic strengthening to reduce pain and improve function in chronic low back pain patients.

Keywords: Low back pain; lumbar stabilization exercise; lumbar dynamic strengthening exercise; visual analog scale; Oswestry disability index.

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INTRODUCTION

Most epidemiological data concerning low back pain (LBP) are from high income countries and there is very little information about low back pain in the population in developing countries. Low back pain affects 60-80% of people at some time in their lives. Low back pain is the pain of variable duration in the lumbar region of the spine. It is a cause of physical morbidity and disability[1,2].

According to the duration of pain, low back pain can be broadly classified into three:

Acute-Acute low back pain can be defined as low back pain which lasts for less than 6 weeks.
Sub-acute-Sub acute low back pain can be defined as low back pain which presents between 6 and 12 weeks.
Chronic -Chronic low back pain can be defined as low back pain which lasts for 12 or more weeks.

Pain usually felt in the lumbo-sacral spinal and para spinal regions. There is a general belief that being overweight or a high Body Mass Index [BMI] is associated with poor subjective health and LBP. However, there is a scientific conflict about this relationship. Weak lumbar extensors results in muscular imbalance between the lumbar and abdominal musculature, which may leads to lumbar syndrome. Physical findings of LBP shows as restricted range of motion, tight hamstring, paravertebral muscle spasms and tenderness. There are numerous factors like genetic aspects, age, smoking history, back pain history, job dissatisfaction, manual handling of heavy physical loads, static or awkward work postures, long sitting or standing jobs, or work related to prolonged squatting, extremes of temperatures, lifting, vibrations, or psychosocial factors, obesity, etc. that may contribute to episodes of LBP[3].

Symptoms of LBP are usually worsened by activity such as bending; extending, twisting and lifting aggravate the symptoms and improved by rest. But there is little research says intense physical labor is related to LBP. Similarly, evidence of gender-based differences in the prevalence of LBP remains completely indecisive. Some studies say that a higher number of women are affected by LBP, but other studies that say both genders are equally affected by LBP. Generally concluded that female patients experience more pain than their male counterparts: the possible reason could be less physical activity and lower muscular strength. It has also been observed that pregnancy is a risk factor for the development of chronic back pain; at least half of all pregnant women experience back pain at some stage during pregnancy, while some of them also have persisting back pain post-partum.

If the low back pain continues to be present for 3 months or more, we can consider it “chronic lower back pain”. Generally, patients are diagnosed based on their history. The specific diagnosis is then formulated based on the examination and clinical outcomes. Questionnaires can be used such as the Oswestry low back pain disability questionnaire[4], as well as a visual analog scale[5], for the patients to find out the intensity of the pain and functional disability of the patient.

Development of the Oswestry Disability Index (ODI) was initiated by John O’Brien in 1976 in a

specialist referral clinic in which a large number of patients with chronic low back pain were seen[5]. The Oswestry disability index is an extremely important tool that researchers and disability evaluators use to measure a patient's permanent functional disability. The visual analogue scale consists of a line drawn with interval scale from 0 to 10. 0 (zero) represents 'no pain' and 10 (ten) represents 'worst pain'[6].

Many healthcare professionals use a variety of diagnostic labels[7]. The management of low back pain includes a wide range of intervention strategies including surgery, drug therapy, and nonmedical intervention like rehabilitation. Exercise therapy is proven to be effective in decreasing pain and improving function in chronic low back pain patients. Exercise therapy of a variety of interventions ranging from aerobic exercises to muscle strengthening and flexibility exercises[8, 9].

Dynamic lumbar strengthening exercise is the one with spinal movement demonstrating effective core and global stabilization technique and endurance in stabilizing musculature. The dynamic lumbar strengthening exercises involve only mobility and strength of spinal muscles. In dynamic lumbar strengthening exercises, due to the load imposed on the spine, patients' low back symptoms may increase which might affect minimal pain reduction and improvement in daily activities.

Dynamic lumbar strengthening exercises activated the extensor (erector spinae) and flexor (rectus abdominis) muscle groups. Exercise intensity (holding time and number of repetition) were increased gradually, based on the tolerance of each patient[10, 11].

Lumbar stabilization exercise and walking exercise should be recommended to patients with chronic low back pain because they help not only to relieve back pain but also to prevent chronic back pain through the improvement of muscle endurance[12]. The main goal of the stabilization exercises is deep motor control of deep trunk muscles (Transversus abdominis and multifidus) restoration and increase in thickness of these stabilizer muscles that result in improved spine stability[13].

METHODS

The study used a pre vs. post experimental design. Colleges in and around Trivandrum and the outpatient department of Bethany Navajeevan College of Physiotherapy were used as study settings. The study duration was 1 year. Based on the inclusion criteria 30 subjects were selected in this study through purposive sampling.

The inclusion criteria include: both males and females, patients suffering non-specific low back pain for more than 3 months, age group: 25-45, post-natal women with normal delivery and individuals who are willing to exercise, whose visual analogue scale score were 5 points or higher and whose low back pain disability indices were 20% or higher were randomly assigned. Other cerebrovascular disease, spinal cord disease, cervical and lumbar spondylitis, cancer, rheumatologic disorder, recent surgeries, patient who are prescribed exercise in the past, patient who seemed to have radicular pain due to nerve root involvement on, physical examination, patients with structural lesion such as spondylolisthesis, vertebral fracture, scoliosis

and kyphosis on x-ray are excluded from this study.

Based on the inclusion criteria, 30 patients with low back pain were included in this study. A brief explanation was given to the participants. After obtaining an informed consent form subjects were recruited into two groups (group A and group B). Before the intervention, the pre- test was conducted on using VAS and ODI questionnaire.

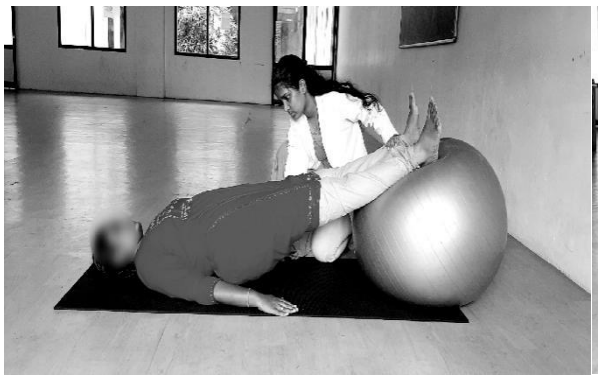
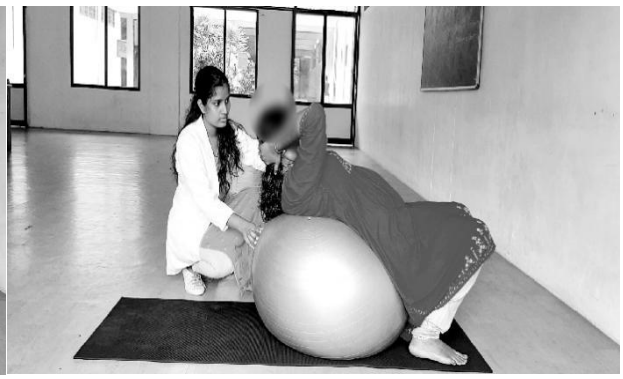
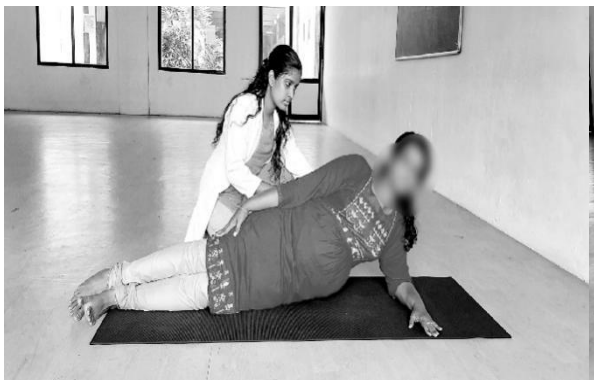
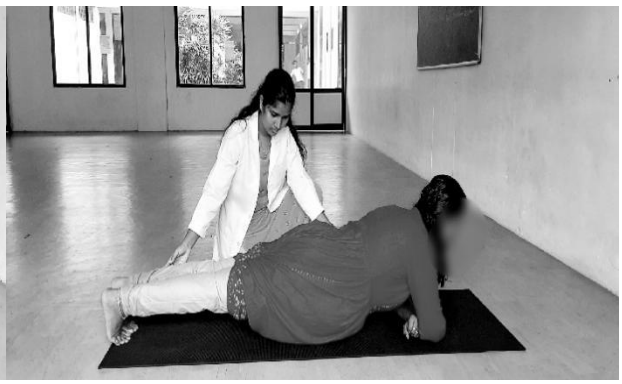
All patients were initially treated with hydro collator packs [10min] in both groups and followed by warm up stretching exercise for 10min before the main exercise and cool down exercise for 10min after each session. Each exercise session lasted 60 minutes and was performed 3 days per week, for 8 weeks.

There are 3 main steps involved in this study. Pre testing, training intervention and post testing. Once the patients were allocated into these groups, an informed consent was collected from them. Prior to pretesting patients were informed about and was demonstrated the testing procedures to achieve familiarization with the procedures.

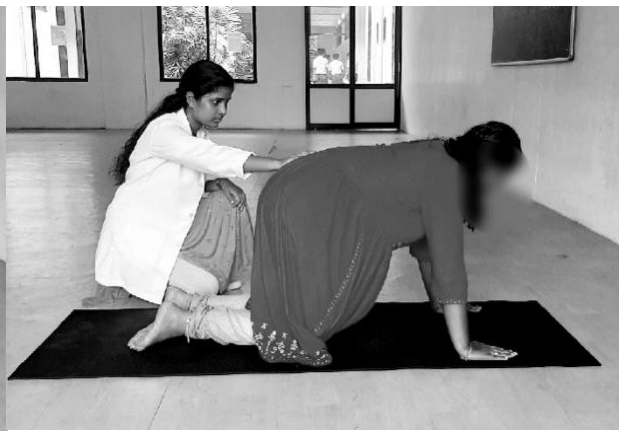
After a brief explanation of lumbar stabilization exercises consisted of 14 exercises, group A subjects were subjected to lumbar stabilization exercises for a period of 8 weeks, 3 sessions per week, per session for 60 minutes. All 14 stabilization exercises were performed once, consecutively, and in the same order. All patients were initially treated with hydro collator packs [10min] in both groups and followed by warm up stretching exercise for 10min before the main exercise and cool down exercise for 10min after each session.

After a brief explanation of dynamic lumbar strengthening exercise; consisted of 14 exercises, group B subjects were subjected to dynamic lumbar strengthening for a period of 8 weeks, 3 sessions per week, per session for 60 minutes. All 14 dynamic lumbar strengthening exercises were performed once, consecutively, and in the same order.

Post test was conducted on group A and group B by Using Visual Analogue Scale for pain and Oswestry disability index for functional disability evaluation after the treatment program.





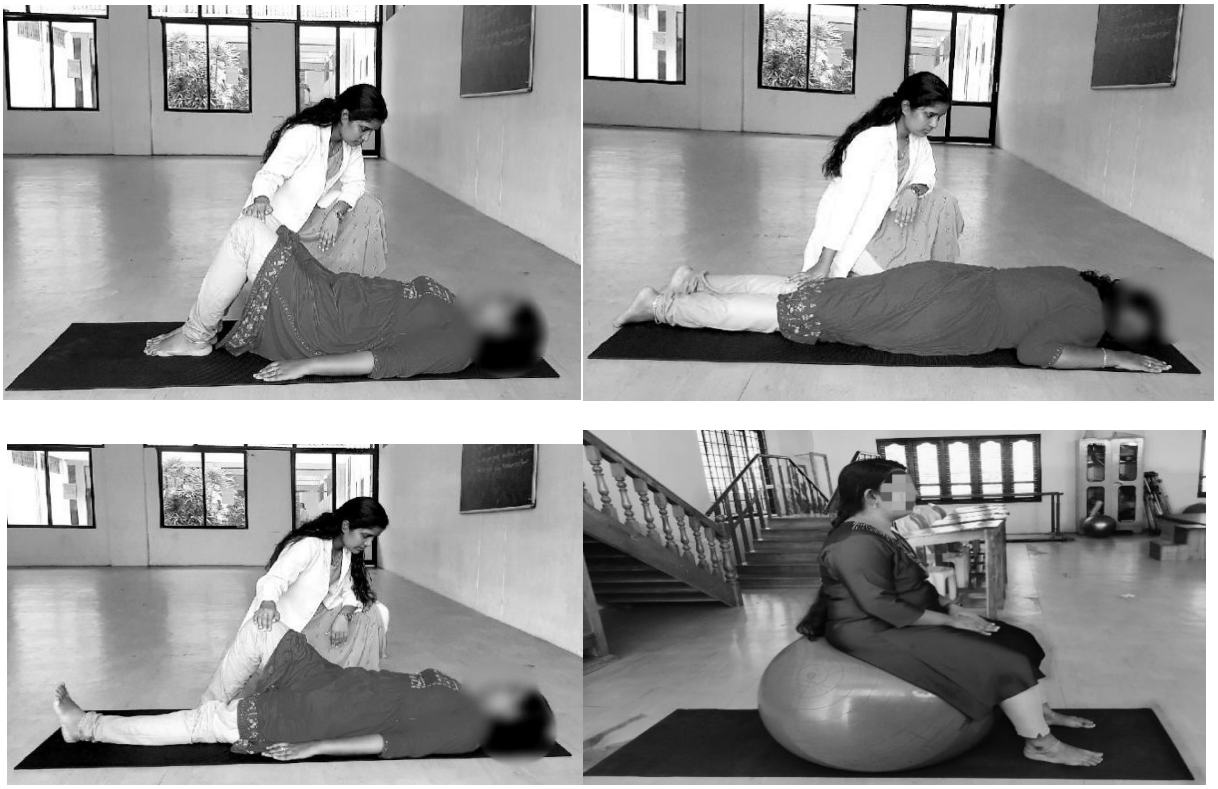
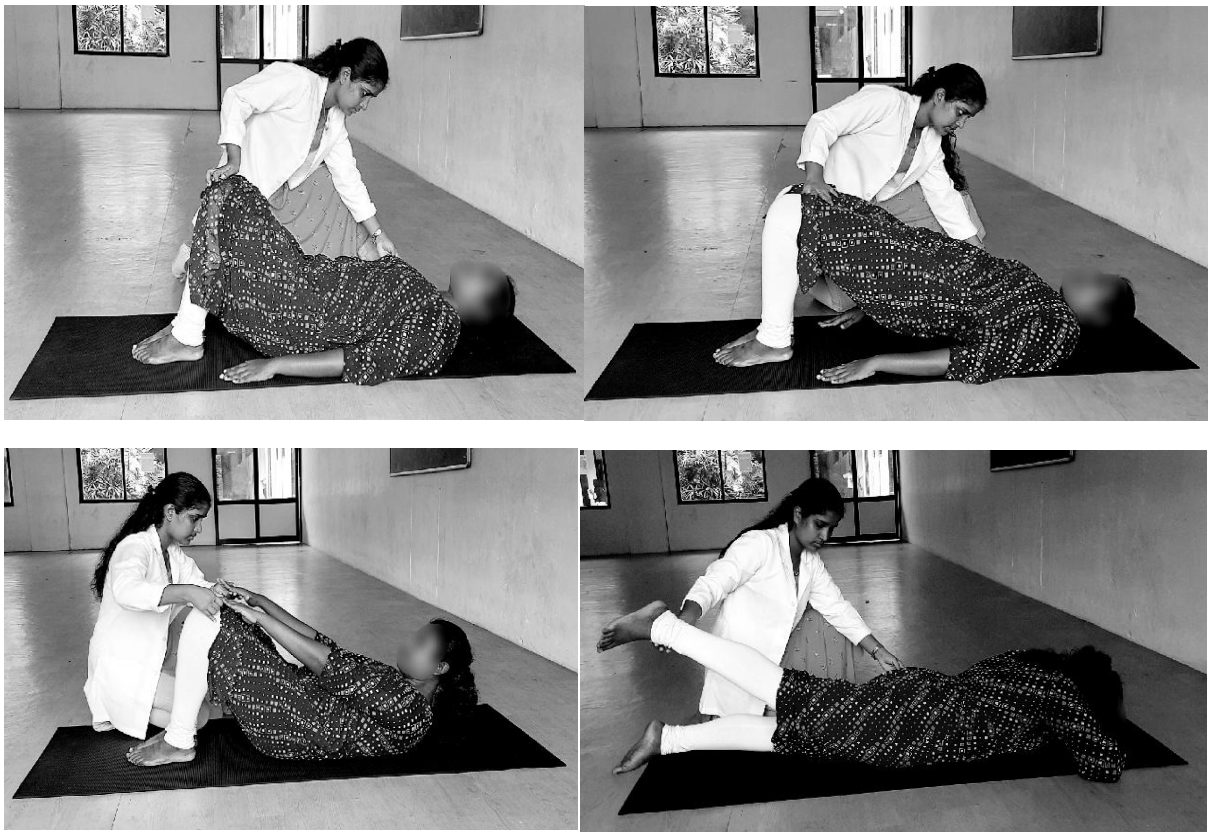
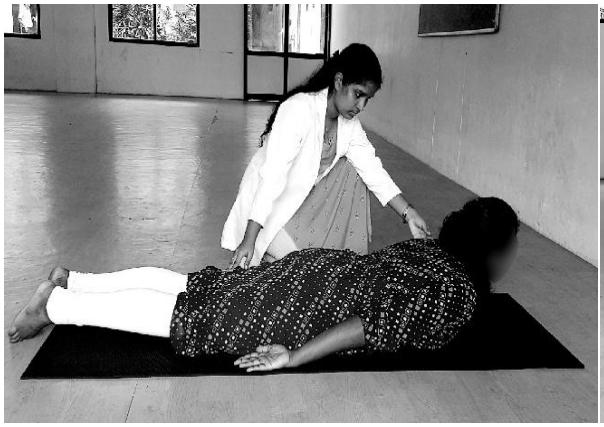
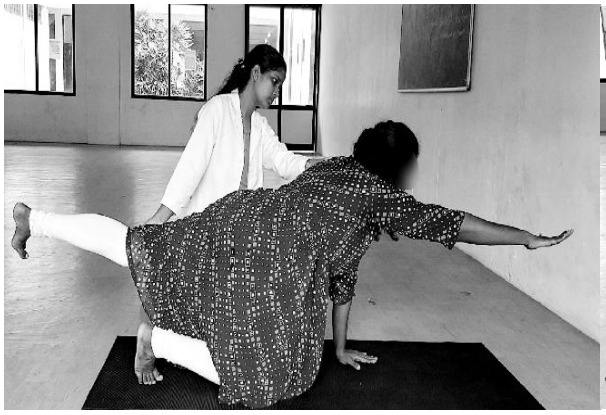


Figure 1 Lumbar Stabilization Exercises (1-14 Positions)







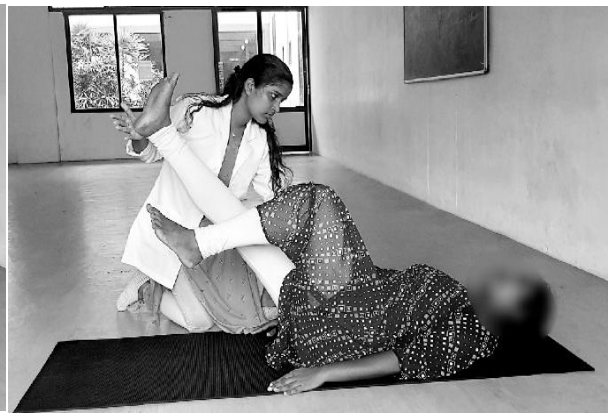
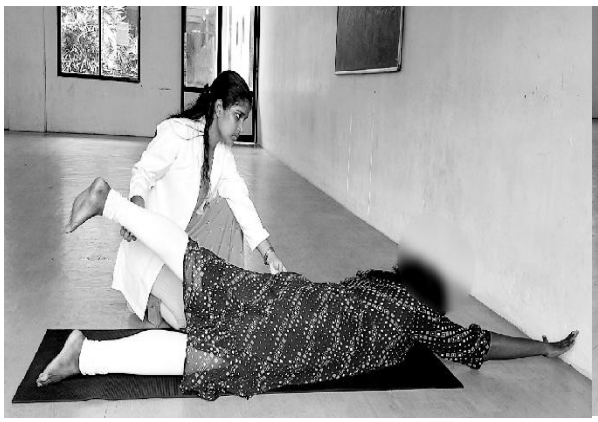
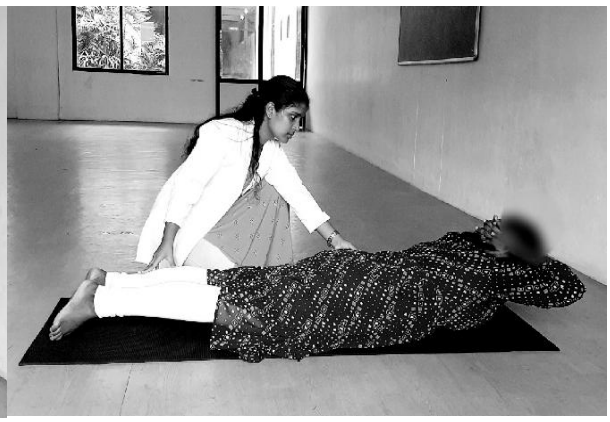





Figure 2. Dynamic Lumbar Strengthening Exercises (1-14 Positions)

Data Analysis: Data analysis was done by using SPSS software version 29 with a significant level set at 95% confidence interval and P value <0.05.Based on the normality non-parametric Mann-Whitney test was applied to find the difference between groups and Wilcoxon Signed Rank test was used to find the effects within the groups.

RESULT

Comparison of Pre test Vs Post Test Scores Visual Analogue Scale (VAS) in lumbar stabilization Group (Group A)

Group A	N	Mean+ Std deviation	Minimum	Maximum	Mean difference	95%confidence interval		P value
						Lower	Upper	
PRE TEST	15	6.933 ± 1.2799	5	9	5	-5.500	-4.500	<0.001
POST TEST		1.933 ± 0.7988	1	3				

Table 1 Comparisonofpre-testvspost-testscoresofVASinlumbarstabilizationgroup (Group A).

Table 1 shows the pre-test and post-test values of VAS i.e., mean with standard deviation, minimum value, maximum value, mean difference, 95% confidence interval and P value of lumbar stabilization group (Group A). Based on the statistical analysis in lumbar stabilization group, the pre-test mean value with standard deviation of VAS was 6.933 ± 1.2799 with minimum value of 5 and maximum value of 9 and post-test mean value with standard deviation of VAS was 1.933 ± 0.7988 with minimum value of 1 and maximum value of 3, the mean difference was 5, 95% confident interval of lower limit was ⁻5.500, upper limit was ⁻4.500 and the P value was <0.001. The result of the study shows that there is statistically significant difference between pre-test and post-test values of VAS in lumbar stabilization group.

Comparison of Pre test Vs Post Test Scores of Visual Analog scale (VAS) In Dynamic Lumbar Strengthening GROUP (Group B)

Group B	N	Mean+ std deviation	Minimum	Maximum	Mean difference	95%confidence interval		P value
						Lower	Upper	
PRE TEST	15	7.600 ± 1.1212	6	9	3	⁻3.500	⁻2.500	<0.001
POST TEST		4.600 ± 0.6325	4	6				

Table 2 Comparison of pre-test Vs post-test scores of VAS in dynamic lumbar strengthening group (Group B).

Table 2 shows the pre-test and post-test values of VAS i.e., mean with standard deviation, minimum value, maximum value, mean difference, 95% confidence interval and P value of dynamic lumbar strengthening group (Group B). Based on the statistical analysis in dynamic lumbar strengthening group, the pre-test mean value with standard deviation of VAS was 7.600 ± 1.1212 with minimum value of 6 and maximum value of 9 and post-test mean value with standard deviation of VAS was 4.600 ± 0.6325with minimum value of 4 and maximum value of 6, the mean difference was 3, 95% confidence interval of lower limit was⁻3.500, upper limit was⁻2.500 and the P value was <0.001.The result of the study shows that there is statistically significant difference between pre-test and post-test values of VAS in dynamic lumbar strengthening group.

Comparison Pre Test Vs Post Test Scores Of Visual Analog Scale between Lumbar Stabilization Group and Dynamic Lumbar Strengthening Group

Group	N	Mean Rank	Sum of Ranks	Mann Whitney U value	Significant (P)
A	15	22.20	333.00	12.000	<0.001
B	15	8.80	132.00		
Total	30				

Table 3 Comparison of pre-test Vs post-test scores of VAS between lumbar stabilization group and dynamic lumbar strengthening group.

Table3 shows the pre-test mean rank and post-test sum of rank of group A and group B, Mann Whitney U test value and significant (P) value of VAS. Based on the statistical analysis the mean rank for group A was 22.20 and for group was 8.80. The sum of rank for group A was 333.00 and for group B was 132.00, Mann Whitney U value was12.000, the P value was <0.001. The result of the study shows that there is statistically significant difference between the pot-test mean rank of VAS in group A and group B. Thepost-test mean rank of VAS shows that lumbar stabilization group(group A)shows significant improvement in pain than in dynamic lumbar strengthening group (group B).

Comparison of Pre test Vs Post Test Scores Of Oswewstry Disability Index (ODI) In Lumbar Stabilization Group (Group A)

Group A	N	Mean+ Std deviation	Minimum	Maximum	Mean difference	95% confidence interval		P value
						Lower	Upper	
PRE TEST	15	26.533 ± 2.2318	23	30	16.733	-17.500	-15.500	<0.001
POST TEST		9.800 ± 3.0048	6	15				

Table 4. Comparison of pre-test Vs post test scores of ODI in lumbar stabilization group (Group A).

Table 4 shows the pre-test and post-test values of ODI i.e., mean with standard deviation, ,mean with standard deviation, Minimum value, maximum value, means difference, 95% confidence interval and P value of lumbar stabilization group (Group A). Based on the statistical analysis in lumbar stabilization group, the pre-test mean value with standard deviation of ODI was 26.533 ± 2.2318 with minimum value of 23 and maximum value of 30 and post-test mean value with standard deviation of ODI was 9.800 ± 3.0048 with minimum value of 6 and maximum value of 15, the mean difference was 16.733, 95% confident interval of lower limit was -17.500, upper limit was-15.500 and the P value was <0.001.The result of the study shows that there is statistically significant difference between pre-test and post-test values of ODI in lumbar stabilization group.

Comparison of Pre test Vs Post Test Scores of Oswewstry Disability Index (ODI In Dynamic Lumbar Strengthening Group (Group B)

Group B	N	Mean+ std deviation	Minimum	Maximum	Mean difference	95%confidence interval		P value
						Lower	Upper	
PRE TEST	15	25.067 ± 2.4339	21	28	5	-7.000	-3.500	<0.001
POST TEST		20.067 ± 2.7637	16	25				

Table 5. Comparison of pre-test Vs post test scores of ODI in dynamic lumbar strengthening group (Group B).

Table 5 shows the pre-test and post-test values of ODI i.e., mean with standard deviation, minimum value, maximum value, mean difference,95% confidence interval and P value of dynamic lumbar strengthening group (Group B). Based on the statistical analysis in dynamic lumbar strengthening group, the pre-test mean value with standard deviation of ODI was 25.067±2.4339 with minimum value of 21 and maximum value of 28 and post-test mean value with standard deviation of ODI was 20.067 ± 2.7637 with minimum value of 16 and maximum value of 25, the mean difference was 5,95% confident interval of lower limit was -7.000,upper limit was -3.500 and the P value was <0.001. The result of the study shows that there is statistically significant difference between pre-test and post-test values of ODI in dynamic lumbar strengthening group

Comparison Pretest Vs Posttest Scores Of Oswestry Disability Index Between Lumbar Stabilization Group And dynamic Lumbar Strengthening Group

Group	N	Mean Rank	Sum Of Ranks	Mann Whitney U value	Significant (P)
A	15	23	345.00	.000	<0.001
B	15	8	120.00		
Total	30				

Table 6. Pre-test mean rank and post-test sum of rank of group A and group B

Table 6 shows the pre-test mean rank and post-test sum of rank of group A and group B, Mann Whitney U test value and significant (P) value of ODI. Based on the statistical analysis the mean rank for group A was 23 and for group B was 8.Thesumofrank for Group A was 345.00 and for group B was 120.00, Mann Whitney U value was 0.000, the P value was<0.001.The result of the study shows that there is statistically Significant difference between the pot-test mean rank of ODI in group A and group B. The post-test mean rank of ODI shows that lumbar stabilization group (group A) shows significant improvement in pain than in dynamic lumbar strengthening group (group B).

DISCUSSION

The aim of the study was to compare the effects of lumbar stabilization exercises versus lumbar dynamic strengthening exercises on patients with chronic low back pain. Conventional dynamic lumbar strengthening exercises activated the extensor (erector spinae) and flexor (rectus abdominis) muscle groups. And it is helps to increase the mobility and improve spinal muscle strength.

In this study, 30 subjects with chronic low back pain were selected on the basis of inclusion and exclusion criteria and were allocated into two groups. Pre-test was conducted on both groups for pain using visual analog scale and for functional disability using Oswestry disability index. Both groups were subjected to interventions for a period of 8 weeks, 3 days per week and each session lasting for an hour. After 8 weeks, post-test was performed on pain and functional disability using the same outcome measure as in pre-test.

On statistical analysis, the pre-test mean score of pain in the lumbar stabilization group was 6.93 3± 1.2799 and the post-test mean score was 1.933±.7988.The pre-test mean score of pain in the dynamic lumbar strengthening group was 7.600±1.1212 and the post-test mean score was 4.600 ± .6325. The mean rank for lumbar stabilization group was 22.20 and sum of rank for lumbar stabilization group was 333.00. Mann Whitney U value was 12.000, the P value was<0.001.

These findings clearly indicates that the lumbar stabilization exercise administered to the subjects in the lumbar stabilization group was found to be more effective in reducing the level of pain than the samples who had been administered with dynamic lumbar strengthening exercise. By strengthening the muscles that support the spine, removing pressure from the vertebral discs and facet joints, alleviating stiffness and improve mobility, improving circulation to better distribute nutrients through the body, including to the vertebral discs and releasing endorphins (naturally pain relieve), all these can relieve pain [16-18].

Pre-test means score of functional disability in the lumbar stabilization group was 26.533±2.2318 and the post-test mean score was 9.800 ± 3.0048. Pre-test mean score of functional disability in dynamic lumbar strengthening group was 25.067 ± 2.4339 and post-test mean score of function in dynamic lumbar strengthening group was 20.067 ± 2.7637. The mean rank for lumbar stabilization group was 23 and sum of rank for lumbar stabilization group was 345.00. Mann Whitney U value was 0.00, the P value was <0.001 [19-21].

These findings shows that the lumbar stabilization exercise administered to the subjects in the lumbar stabilization group was found to be more effective in improving the level of function than the samples that had been administered with dynamic lumbar strengthening exercise. Among the abdominal muscles, transverses abdominal, multifidus and internal oblique muscles help to increase the intra-abdominal pressure, thereby contributing to the spinal and pelvic stability [22,23].

Lumbar stabilization exercise group included lumbar dynamic exercises, which may have strengthened the lumbar extensors at the large lumbar flexion angle in lumbar stabilization group of patients. However, functional improvements was better in the lumbar stabilization exercise group[24,25] .

Limitations of the study were, sample size is small and study duration was less, intervention was not progressive, no follow-up was done (long term), no randomization was done, muscle strength of the patients were not measured after the treatment, the results cannot be generalized to all patients with chronic LBP and risk of potential bias not mentioned.

Further studies are needed with larger sample sizes and longer follow-up periods using randomized controlled trial. More studies can be done using muscle strength as an outcome measure and should be evaluated by using specific tools such as needle electromyography, ultrasound measurements of deep muscle thickening, etc.

CONCLUSION

The study concluded that lumbar stabilization exercises are more effective than the dynamic lumbar strengthening exercises in reducing pain and improving function for chronic low back pain patients.

There was statistically significant difference for pain and disability within the group. Therefore; lumbar stabilization exercises and dynamic lumbar strengthening exercises can be incorporates with other physiotherapy treatments for chronic low back pain patients.

Ethical Approval: Ethical clearance has been obtained from the institutional ethical committee of Bethany Navajeevan College of Physiotherapy, Trivandrum, Kerala, Reference number BNCP/MSK/3 dt.06/09/2021.

Conflict of Interest: There was no conflict of interest to conduct this study

Fund for the Study: No funding received for any organization.

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