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Original Research Article

Efficacy of core stabilization program and conventional exercises in low back pain

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ABSTRACT

Background: Patients experiencing low back pain (LBP) often benefit from therapeutic exercise. These exercises can retrain trunk muscles and improve spinal stability and sensory integration. Consequently, we aimed to compare the efficacy of a core stabilization program and conventional exercises in low back pain.
Methods: This prospective, comparative study comprised 192 subjects aged 20-60 with nonspecific chronic low back pain (NSLBP). Core stabilization or usual physical therapy activities were randomly assigned to groups C or R. Both treatment groups received TENS and ultrasound therapy. Pretreatment, second, fourth, and sixth-week post-treatment outcomes were documented using a visual analogue scale (VAS).
Results: Both groups were female-dominated. Height, weight, and BMI were comparable. At baseline, group C had a mean VAS score (5.69±1.80), while group R had (5.52±1.42). P value 0.4684 indicates no significant difference between exercise groups. At the final assessment, group C had a considerably ($p<0.0001$*) lower mean VAS score (2.96±0.39) than group R (3.89±0.98). Group C had a substantially higher mean VAS score change from baseline to the final evaluation (-2.73±0.51) than group R (-1.18±0.79).
Conclusions: Core stabilization exercise is more effective than routine physical therapy exercise in terms of greater reduction in pain in chronic NSLBP.

Keywords: Core stabilization exercise, Nonspecific chronic low back pain, Routine physical therapy exercise, Ultrasound

INTRODUCTION

Globally, low back pain (LBP) causes disability and socioeconomic issues. The 2010 Global Burden of Disease (GBD) survey showed that LBP was the most grievous impairment in relations of years lived with disability. 18.3% of the population has LBP at any given time, 38.0% within a year, and 38.9% over their lifetime.[1,2] In India, the prevalence is significantly higher, especially among women, rural people, and elementary employees.[3] LBP causes lower back discomfort that may or may not go to the legs. Nonspecific LBP (NSLBP) accounts for 85% of LBP cases. Functional tasks are hampered by NSLBP patients' poor postural control. Postural control relies on ocular, vestibular, and somatosensory input. For posture regulation, the somatosensory system's proprioception integrates sensory input and motor output. A systematic review found that chronic LBP patients have worse proprioceptive impairments than healthy people.[4-6] Proprioception problems may cause LBP by altering lumbar spine motion. LBP patients often have poor neuromuscular control and a stiff spine. According to recent research, patients with subacute NSLBP had poorer balance control and proprioception than healthy people.[7] Within 24 hours of acute LBP onset, the trunk-stabilizing lumbar

multifidus (LM) muscle may be less efficient. The motor adaptation to chronic LBP pain affects the motor cortex and motor response planning. Exercise must be started early for maximum recovery and to avoid persistent discomfort.[8] Core stabilisation (CSE) and traditional workouts are utilised to treat LBP. The transversus abdominis (TrA) and LM muscles co-activate in CSE to stabilise the spine. CSE can reverse motor cortical abnormalities caused by pain, improve muscle behaviour, and increase neuromuscular spinal stability.[9] In LBP, CSE and conventional workouts have been shown to reduce pain, disability, and trunk muscle activation.[10,11] Few studies compare these exercise programmes in subacute LBP patients. Therefore, we aimed to compare the efficacy of the core stabilization and conventional exercises in low back pain.

METHODS

This study was a two-year prospective comparative study conducted during May 2021 to April 2023 at the Department of Physical Medicine and Rehabilitation, King George's Medical University, Lucknow. Prior to conducting the study, ethical approval and informed consent was obtained. 192 subjects were selected for the study using a non-probability sampling technique.

The sample size was determined using the formula:[12,13]

$$N = \frac{Z^2 \times p(1-p)}{d^2}$$

The study included both genders aged between 20 and 60 years who had nonspecific chronic mechanical low back pain. Patients with certain ailments including acute low back pain, a history of spinal fracture or surgery, disc pathology, spondylolisthesis, radicular pain, spinal tuberculosis, and systemic diseases, were precluded from the study. Patients were randomly divided into two categories: core stability exercise group (group C) and routine physical therapy exercise group (group R), using a computer-generated random number table. A physical therapist provided both groups with supervised exercises. Demographics details were recorded. A visual analogue scale (VAS) was used to evaluate the pain intensity, with 0 indicating no discomfort and 10 indicating the worst possible pain. A change between 1.1 and 1.2 cm was considered a clinically significant improvement.[14] Before treatment, a thorough musculoskeletal examination of the lumbar spine was performed, and baseline pain levels were recorded. Each treatment session lasted approximately forty minutes, followed by a five- to ten-minute break. Each treatment group received one session per week for six weeks. Post-treatment pain measurements were taken after the second, fourth, and sixth treatment weeks. All participants received therapeutic ultrasound and TENS treatment at the lumbar spine as a baseline. In addition, they were given printed handouts of the exercises to perform at home twice per week and instructed to avoid intense workouts during treatment.

Statistical analysis

The data was analysed using version 20 of the SPSS for Windows programme. P≤0.05 was deemed statistically significant. Frequency tables were employed to summarize group measurements. Further, to compare the development among two groups between two visits, the Wilcoxon t-test was used. Additionally, the Mann-Whitney U test and Friedman ANOVA were employed to demonstrate the variation in pain scores both between and within groups.

RESULTS

The mean age of the patients in groups C and R was 47.51±7.64 and 46.73±6.68 years, respectively. We observed female preponderance in both groups. The anthropometric showed comparable height, weight and BMI. No substantial difference was recorded in the demographics (Table 1).

Table 1: Demographic parameters of enrolled patients among groups.

Demographic parameters	Core stabilization exercise group (n=96)		Routine physical exercise group (n=96)		P value
	N/mean	%/SD	N/mean	%/SD	
Age	47.51	7.64	46.73	6.68	t=0.753; p=0.4523
Gender					
Male	42	43.75%	39	40.63%	X=0.191; p=0.6619
Female	54	56.25%	57	59.38%	
Anthropometry					
Height	1.85	0.32	1.83	0.36	t=0.407; p=0.6846
Weight	65.30	10.25	64.96	9.51	t=0.238; p=0.8119
BMI	25.48	2.83	25.28	3.20	t=0.459; p=0.6470

Table 2: Comparison of the baseline and final value for VAS of the enrolled patients among the groups.

VAS	Core stabilization exercise group (n=96)		Routine physical exercise group (n=96)		P value
	Mean	SD	Mean	SD	
Baseline	5.69	1.80	5.52	1.42	t=0.727; p=0.4684
Final	2.96	0.39	3.89	0.98	t=8.639; p<0.0001*
Mean change (final- baseline)	-2.73	0.51	-1.18	0.79	t=16.151; p<0.0001*

At baseline, group C had a mean VAS score (5.69±1.80), while group R had a mean score (5.52±1.42), (p=0.4684). However, at the final assessment, group C had a significantly (p<0.0001*) lower mean VAS score (2.96±0.39) compared to group R with a mean score (3.89±0.98). The mean change in VAS scores from baseline to the final assessment was also significantly greater in group C (-2.73±0.51) compared to group R (-1.18±0.79) (Table 2). These data represents that the core stabilization exercise group experienced a greater reduction in VAS scores and symptom improvement than the routine physical exercise group.

DISCUSSION

The present study showed that core stabilization exercises and regular physical therapy exercises are statistically effective for the treatment of LBP. However, from a clinical standpoint, the group performing core stabilization exercises experienced a greater reduction in pain than the group performing routine physical therapy exercises. Areeudomwong et al studied the effects of a 10-week core stabilization programme in individuals with clinical lumbar spine instability.[15] Similar to our findings, the control group in study received trunk muscle stretching and hydrocollator therapy, and both treatment groups experienced a reduction in pain and disability. The hypothesis posits that core stabilization exercises enhance the function of segmental muscles, leading to improved overall functionality and reduced pain in individuals suffering from chronic NSLBP. This hypothesis is supported by studies conducted by Koumantakis et al and O'Sullivan et al, which reported pain reduction in subjects assigned to core stabilization exercises and emphasised the advantages of the abdominal drawing-in manoeuvre (ADIM), which integrates muscle into tasks by providing powerful biofeedback.[16,17] In another study, it was showed that ADIM aids in stabilising the lumbar spinal segments during functional activities in healthy individuals.[18] In our study, core stabilization exercises substantially decreased pain in individuals with LBP, providing additional evidence for the efficacy of this treatment. Similarly, Costa et al established that motor control exercises are preferable to electrotherapeutic modalities for treating chronic NSLBP.[19] In their study, the study group engaged in exercises designed to activate the transversus abdominis and multifidus muscles. As patients developed adequate control, they moved to a lot more complex functional tasks focusing on core muscle activation. Over the course of 12 weeks and eight treatment sessions, the control group received detuned short-wave diathermy and placebo ultrasound therapy. In both groups, pain and disability were significantly reduced, as measured by the numeric pain rating scale (NPRS) and the Roland-Morris disability questionnaire, respectively. However, the reduction was clinically pronounced in the treatment group compared to the control group. After 4 weeks of intervention, Hlaing et al found no considerable difference in pain alleviation between the core stabilisation exercise (CSE) and strengthening exercise (STE) groups.[20] Nevertheless, a higher percentage of subacute NSLBP patients in the CSE group (38.89%) recovered than in the STE group (16.67%). Moreover, functional impairment was extensively reduced in the CSE group versus the STE group. These results suggest that CSE improves trunk muscles' activation and coordination, enhances the stability of the lumbar segment, and decreases spinal loading, pain, and functional impairment. This is consistent with previous research, which supports the idea that CSE can enhance the performance of back movement by alleviating pain, improving joint repositioning sense accuracy, and minimising functional impairment.[21,22] Statistical analysis indicates that core stabilization exercises and routine physical therapy exercises are equally effective for the management of LBP. From a clinical standpoint, however, core stabilization exercises significantly reduce discomfort than conventional physical therapy exercises. These findings support the use of core stabilization exercises to improve pain, function, and disability in patients with chronic NSLBP, as supported by previous research. It is suggested that future research investigate the long-term effects and fundamental mechanisms of core stabilization exercises in this population in greater depth.

Limitation of study are as follows: Firstly, the study was conducted at a single medical university, which may limit the generalizability of the findings to a broader population. It would be beneficial to replicate the study across multiple healthcare settings and diverse patient populations to ensure the results are applicable more widely. Secondly, the study's follow-up period was limited to six weeks post-treatment. A more extended follow-up to assess the sustainability of the observed improvements in pain relief and functional outcomes

would provide a more comprehensive understanding of the interventions' long-term effects.

CONCLUSION

In this study, we found that core stabilization exercise yielded a greater pain reduction than routine physical therapy exercise. By targeting the underlying neuromuscular control and stability of the lumbar spine, these findings suggest that core stabilisation exercises may be more efficient for managing chronic NSLBP. Incorporating core stabilization exercises into treatment protocols for individuals with chronic LBP may improve pain management. Additional research is warranted to explore the long-term effects and potential mechanisms underlying the observed benefits of core stabilization exercises in LBP.

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