Original Article

Effectiveness of Lumbar Stabilization Exercise in Improving Lumbar Spine Endurance by Using Sorenson's Test and EMG Analysis for People with Chronic Low Back Ache

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Abstract

Background: Strength endurance in lower back region is the most important factor for chronic low - back pain. There are several treatments for strengthening low back muscle. Strength and endurance that have proven benefit in CLBP patients; however, there are very few studies that focus on lumbar stabilization exercises.

Purpose: The intention of this study was to improve the strength and endurance more effectively than usual programs by performing lumbar stabilization exercises.

Materials And Methods: This Quasi-Experimental study had 40 participants with persistent LBP, aged 25 to 50, divided into lumbar stability (n=20) and lumbar strengthening (n=20) groups. sEMG measured strength endurance, NPRS scale measured pain, before and after intervention**.**

Results: Lumbar stabilization exercises (Group A) were significantly more effective than static stretching and strengthening exercises (Group B) in treating persistent low back pain, with $p<0.001$ in outcome measures.

Conclusion: Lumbar stabilization exercises have been demonstrated to be more effective than conventional therapies in patients with CLBP.

Keywords: Chronic low back ache (CLBP), surface Electromyography, strength endurance

Introduction

One of the most prevalent musculoskeletal conditions is low back pain, which can cause soreness or discomfort in the hip, buttocks, or lumbar area [1]. It develops as a result of intense physical activity, frequent twisting, bending, and carrying motions, and prolonged periods of stiffness. Psychological issues including anxiety, depression, and/or fear might also have an impact on it [2]. One of the main factors contributing to disability is chronic low back ache. Lumbago or paraspinal muscular hypertonicity is not the only cause of back pain. Since back pain affects 12 to 33% of people at any given time and is mechanical in 90% of cases, back pain is likely to receive the majority of medical attention [3].

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CLBP affects more than 500 million people globally. Prevalence of CLBP was 4.2% in people between the ages of 24 and 39 and 19.6% in people between the ages of 20 and 59. Most people's back pain subsides on its own. Studies on prevalence of low back pain across India showed 6.2% to 92%[4]. The higher prevalence for LBP in school girls than in school boys is probably caused by psychological factors, female hormone changes, and menstruation. After menopause, females exhibited a greater incidence with LBP than males as compared with young and elderly individuals [5].

However, a significant percentage of these patients eventually develop persistent symptoms. Every case of CLBP includes the symptom of pain, which must last for at least 3 months or manifest itself episodically throughout a 6-month period without any 29 obvious pathoanatomical causes. Studies on back pain in younger age groups typically concentrate on instances of the condition caused by secondary causes, particularly those connected to inflammatory diseases[4]. When an individual is resting, the biomechanical properties of muscles and fascia are intrinsic components associated with this tissue, and in the back, these properties play a vital role in maintaining spine stability[6].

The restoration of appropriate kinetic function is thought to depend heavily on core stability exercises, which have gained popularity as a type of therapeutic exercise [8]. Patients with CLBP have been advised to perform trunk stability exercises to increase their quality of lumbar segmental motion, lower their pain, and lessen their disability [9]. During isometric contractions, the erector spinae and longissimus muscle fibres have been recruited in both upper and lower portions of lumbar spine [10]. These results suggest that the localised control of superficial lumbar muscles may have a considerable impact on trunk motions. There is some research evidence for exercises such as dead bug, trunk curl, quadruped and pelvic bridging which could help in relieving pain and also enhancing the functional performance[11].

A technique called superficial electromyography (s EMG) was employed to assess changes in the lumbar stabilizing muscles' endurance. Rectus abdominis, Oblique muscles and Erector spinae muscle activity was recorded using surface electromyographic (EMG) technology [12]. McGill et al conducted a study on male college students to determine the normative reference values for spinal flexor and extensor muscular endurance test timings, which revealed a ratio of 0.99:1.00[13]. The rectus abdominis, external obliques, the erector spinae are some of the muscle groups that make up the core [14,15].Low back endurance has been linked in reducing LBP, according to studies[16,17]. In order to prevent and treat a variety of lumbar spine and musculoskeletal diseases, strengthening of these core muscles has been recommended[18]. The core muscles are the centre of the body where the most kinetic chain transfers force to the extremities during physical activity[19].

As a result, the current study compares how well spinal stabilization exercises and traditional workouts work to increase strength and endurance in those with CLBP. According to surface electromyography, we believe that combining spinal stabilization workouts with general strengthening activities would improve lumbar strength endurance more effectively.

Aim

The primary objective of this research investigation is to see how lumbar stabilization exercise influences individuals in improving lumbar spine endurance using surface EMG with conventional lumbar strengthening exercise in subjects with CLBP.

Material and Method

This study was conducted at Saveetha Medical College and Hospital (SIMATS), Thandalam, Chennai, in the outpatient department from May 18 2022 to July 23 2022. Following the determination of their eligibility based on the inclusion and exclusion criteria, a total of 30 subjects were invited to participate in the study. The subjects who agreed to participate were split into Group A and Group B.

Inclusion criteria:

- Those who have CLBP lasting more than three months.
- Both genders belong to the 25–50 age.
- Patients with CLBP were the study's participants, and the study's design was an RCT.

Exclusion criteria:

- The sample size was no more than 40 subjects.
- Participants had clinical signs of spondylolisthesis, lumbar stenosis, infectious pathologies in the spine, or inflammatory diseases with spine involvement.
- Participants had previously undergone spinal surgery.

Outcome measures

Verbal Numeric Pain Rating Scale (NPRS)

The patient or individual experiencing pain is asked to rate their pain intensity on a scale of 0 to 10, where: 0: No pain 1-3: Mild pain (noticeable, but not bothersome) 4-6: Moderate pain (interferes with daily activities) 7-9: Severe pain (disabling and difficult to tolerate) 10: Worst possible pain.

Surface Electromyography:

High density-surface EMG (HD-sEMG) is a non-invasive technique to measure electrical muscle activity with multiple (more than two) closely spaced electrodes overlying a restricted area of the skin. The clinical studies concerned muscle fatigue, motor neuron diseases (MND), neuropathies, myopathies (mainly in patients with channelopathies), spontaneous muscle activity and MU firing rates. In this Rectus Abdominis, Erector spinae and External Oblique muscles were taken for analysing the strength endurance for chronic low back pain patients before and after the exercise protocol was performed.

Procedure

Participants were divided into two groups using randomization. One blinded randomization was used to choose which intervention was written and placed in an envelope.

From this, Group A receives the exercise programme for spinal stabilization (Intervention group) while Group B receives the exercise programme for spinal strengthening (Conventional group).

Each group will be evaluated using surface electromyography for pre- and post-test results prior to the treatment programme. We chose 4 lumbar stabilization exercises that are frequently advised. After analysing a number of different core strengthening exercises, workouts were chosen based on a number of parameters. Exercises that could easily have their intensity increased gradually and had adjustments that were simple for the participants to understand were mostly chosen. The programme consisted of positions such as supine and prone lying. The curl up and the bird dog exercises were performed in the supine position, while the Superman and the bird dog exercises were performed in the prone position. Dead bug was performed for 20 times throughout the course of three sets. Duration of the session was 30 mins for 3 days per week. Initial sets and repetition were 1 set, 10 repetitions. Initial intensity of exercises was light to moderate (67-65% of 1 RM).

Fig 1: SUPERMAN EXERCISE

Fig 2: BIRD DOG EXERCISE

Fig 3: CURL UP EXERCISE

Fig 4: DEAD BUG EXERCISE

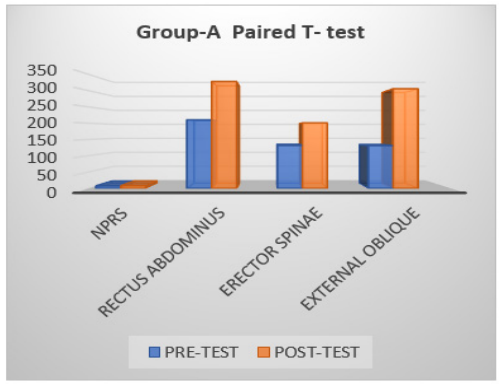
Fig 5: BACK EXTENSION EXERCISE

Fig 6 : PELVIC TILT EXERCISE

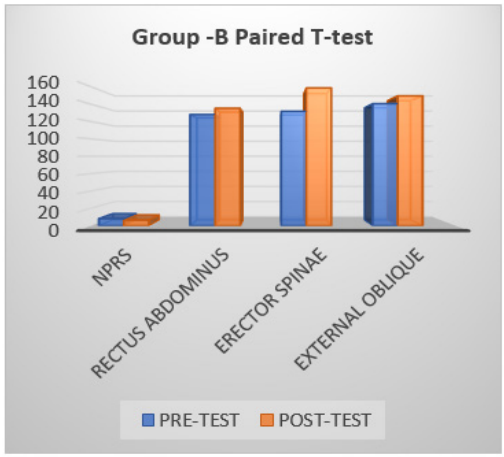
Fig 7: KNEE TO CHEST EXERCISE

Fig 8: GOOD MORNING EXERCISE

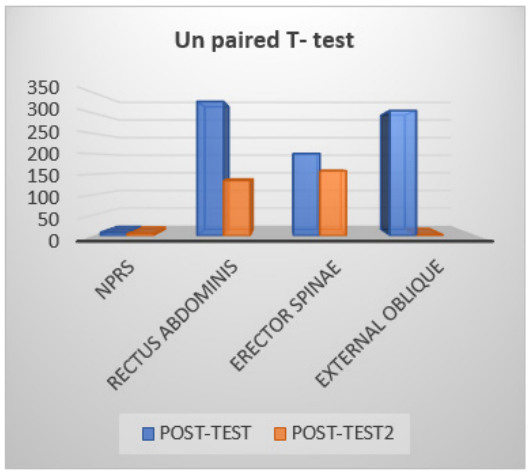
Data Analysis



Graph No. 1: INTERPRETATION: Graph No.1 shows that the values are extremely statistically significant.



Graph No. 2: INTERPRETATION: Graph No.2 shows that the values are extremely statistically significant.



Graph No. 3: INTERPRETATION: Graph No.3 shows that the values are extremely statistically significant.

Result

In a study on chronic low back pain, 40 individuals were split into two groups. Group A received Spinal stabilization exercise, with NPRS decreasing significantly from 7.93 to 3.47 ($p < 0.0001$). Surface EMG showed increased muscle activity. Group B, treated with static stretching and strengthening, also saw a reduction in NPRS from 8.27 to 6.67 ($p < 0.0001$) and moderate EMG changes.

Discussion

This study focused on the potential benefits of lumbar stabilization exercises for patients with persistent chronic low back pain (CLBP). It aimed to assess the effectiveness of spinal stabilization exercises in combination with general exercise for treating CLBP. The research included 40 individuals, with 20 participants in each group, and the allocation was done using the Convenient Sampling method. Both Group A and Group B consisted of 10 men and 10 women.

The study participants had a mean age of 30 in Group A and 40 in Group B. The researchers used the Numerical Pain Rating Scale (NPRS) and Strength Endurance as outcome measures, evaluating the participants every other day over a 45-day period. Pre and post analyses were conducted on the 1st and 45th days.

The findings revealed significant improvements in the endurance capacity of stabilizing muscles and a reduction in pain in both groups. However, the group receiving lumbar stabilization exercises (Group A) demonstrated a substantial increase in strength endurance compared to the group undergoing static stretching and strengthening exercises (Group B). This suggests that lumbar stabilization exercises may be particularly beneficial for patients with CLBP.

In contrast, the pain rating for the stretching and strengthening exercises in Group B did not change significantly. This could be attributed to the nature of static stretching, which primarily focuses on muscle lengthening rather than endurance. Some research suggests that improved range of motion (ROM) may result from increased tolerance for stretching, rather than just muscle lengthening.

The study highlights the importance of standardized classification systems for CLBP, as clinical manifestations vary significantly. Utilizing more uniform groupings of patients with CLBP may enhance treatment outcomes. The research indicates that both lumbar stabilization exercises and general exercise interventions can effectively alleviate discomfort associated with CLBP in a relatively short time frame.

In summary, the study emphasizes the potential benefits of lumbar stabilization exercises in managing persistent low back pain by enhancing muscle endurance. Incorporating such exercises in treatment plans for patients with CLBP can lead to positive outcomes and improved physical therapy approaches.

Conclusion

According to the findings, Group A (Lumbar stabilization exercise) is far more beneficial than Group B (static stretching and strengthening exercise) in treating persons with persistent low back pain.

Ethical Clearance: The study was approved by the Committee of Institutional Scientific Review Board. T

Funding: None Self

Conflict of Interest: The author declared that there is no conflict of interest.

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