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Comparing The Effect Of Lumbar Stabilization Exercise With And Without Motor Control Training On Pain And Function In Individuals With Chronic Low Back Pain Among Sewing Machine Operators

Jabiulla Firoj Kazi[1], Dr. Mandar Malawade[2]
[1](intern) Krishna College Of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India.
[2]Professor, Head of Department, Department of Paediatric, Krishna College Of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad Maharashtra, India.

ABSTRACT

Background: *Chronic Low back pain (CLBP) is commonly associated with occupational risk factors such as prolonged working hours, sustained awkward postures, repetitive movements, and inadequate rest periods. Studies show that working beyond eight hours, sitting continuously for over two hours, and performing monotonous tasks significantly increase the risk of neck and lower back pain. Sewing machine operators are particularly vulnerable to CLBP due to the nature of their work. Chronic LBP is linked to structural and histomorphologic changes in the lumbar paraspinal muscles, including muscle atrophy, fat infiltration, and poor neuromuscular coordination, which contribute to pain, muscle deconditioning, and reduced function.*

To address these issues, various exercises have been recommended, including lumbar stabilization exercises (LSE), motor control exercises (MCE), core strengthening, lumbar flexion exercises, walking programs, and bracing. Among these, LSE and motor control training target deep stabilizing muscles, enhancing spinal control and posture. Research shows that motor control and Pilates-based stabilization exercises are more effective than minimal intervention and as effective as other exercise types. Core stability and back pain-specific stabilization exercises outperform general exercise in improving spinal function. Overall, strength, coordination, and stabilization-based exercises are most effective in managing chronic LBP.

Methods: *A total of 100 participants who are sewing machine operators and diagnosed with chronic low back pain were included in this interventional study. Participants underwent a structured physiotherapy protocol, five times a week for six weeks. Pre- and post-treatment assessments were conducted using the Numeric Pain Rating Scale (NPRS) and Oswestry Disability Index (ODI) to assess the impact of back pain on daily functional activities, Prone Plank Test and Pressure Biofeedback Test for Lumbar Muscle Endurance & Motor Control. Data analysis was performed using paired t-tests.*

Result: *A significant reduction in pain was observed ($p < 0.001$). Additionally, there was a statistically significant increase in functional capacity and core stability and endurance ($p < 0.001$).*

Conclusion: *The lumbar stabilization exercise (LSE) with motor control training (MCT) is significantly more effective than LSE alone in reducing pain, improving function and enhancing the core muscle endurance in individuals with chronic low back pain (CLBP) among sewing machine operators.*

Key words*: Lumbar Stabilization Exercise (LSE), Motor Control Training (MCT), Chronic Low Back Pian (CLBP), Sewing machine operators*

INTRODUCTION:

Musculoskeletal disorders (MSDs) are a significant occupational health issue, particularly prevalent among workers engaged in physically demanding and repetitive tasks, such as healthcare professionals and industrial labourers. These conditions are the most commonly reported work-related health problems and are a leading cause of long-term disability and absenteeism, especially among individuals in their most productive years. Among all MSDs, low back pain (LBP) is the most widespread and disabling condition, posing substantial clinical, social, and economic challenges. It leads to reduced work efficiency, increased healthcare utilization, and a marked decline in the quality of life, making it a critical global public health concern [1,2,3].

LBP is often associated with occupational risk factors such as prolonged work hours, sustained awkward postures, repetitive movements, and insufficient rest periods. Research indicates that working beyond eight hours per day, sitting continuously for more than two hours, and performing monotonous, repetitive tasks significantly increase the risk of developing both neck and lower back pain. Sewing machine operators are particularly susceptible to LBP and other upper body MSDs due to the nature of their work. They are required to maintain a static seated posture for extended periods while performing repetitive tasks with minimal ergonomic support [1,4].

Acute low back pain (LBP) may persist beyond the initial episode and progress into chronic LBP if not managed effectively within a three-month period. Chronic LBP is often associated with histomorphologic and structural alterations in the lumbar paraspinal muscles. These changes include reduced muscle size, increased fat infiltration, and atrophy of specific muscle fibers [5,6], resulting in weakness and excessive fatigability of the paraspinalis muscles [7,8]. In addition to these structural changes, poor neuromuscular coordination of the paraspinal muscles has also been identified in individuals with chronic LBP [7]. These factors contribute to a vicious cycle of pain, muscle deconditioning, and functional impairment [8,9].

Exercise therapy has been shown to be effective in breaking this cycle by improving back extensor strength, spinal mobility, muscular endurance, and reducing functional disability. Several forms of exercise have been recommended for the management of chronic LBP. These include lumbar stabilization exercises (LSE), motor control exercises (MCE), core strengthening exercises, lumbar flexion exercises, walking programs, and bracing techniques. Among them, LSE and MCE specifically target the deep stabilizing muscles of the spine and aim to enhance spinal control and posture. These exercises are crucial in reducing pain, preventing recurrence, and improving overall function in individuals suffering from chronic LBP [10].

Motor control exercises and Pilates-based stabilization exercises have demonstrated superior outcomes compared to minimal or no intervention in the management of chronic low back pain (CLBP). These approaches are at least as effective as other forms of exercise in improving pain and function [11,12]. Core stability exercises [13] and back pain-oriented stabilization exercises [14] have also shown greater effectiveness compared to general exercise programs, particularly in enhancing spinal control and reducing symptoms. Overall, strength/resistance training and coordination or stabilization-focused exercise programs appear to be more beneficial than other interventions for treating CLBP [15].

Motor control exercises result in significant improvements in pain, function, and overall disability. Moreover, in long-term outcomes, motor control exercises remain superior to inactivity or minimal intervention, helping prevent recurrence and promoting sustained improvements. However, when compared to other active exercise modalities over the long term, stabilization and core stability exercises do not demonstrate significantly greater effectiveness. This suggests that while these targeted exercises are valuable for initial symptom relief and functional improvement, their long-term benefits may be comparable to other structured active exercise regimens. Nonetheless, their role in addressing neuromuscular deficits, enhancing muscle coordination, and promoting spinal stability makes them a preferred choice in comprehensive rehabilitation strategies for CLBP [13,16] [17].

METHOD:

The Ethical Committee and Protocol Committee authorized the research investigation. The research is an interventional study involving 100 participants from the Karad, Maharashtra, India. This research recorded the pre- and post-treatment values between the same group that lasted for a duration of 6 months. The goal of this study was to comparing the effect of lumbar stabilization exercise with or without motor control training on pain and function in individuals with chronic low back pain among sewing machine operators. And to explore the experiences and perceptions of patients and health care providers regarding physiotherapy interventions. This study was conducted as per inclusion and exclusion criteria. Participants were briefed on the study's nature, duration, and intervention in their language of choice.

INCLUSION CRITERIA

1) Occupation: Currently working as a sewing machine operator for at least 6 months
2) Work duration: Working for at least 5-6 hours a day, 5 days a week

3) Back pain symptom: experiencing chronic low back pain, stiffness or discomfort in the back region.

EXCLUSION CRITERIA

1) Part time or temporary sewing machine operators
2) Participants with pre-existing back or musculoskeletal conditions unrelated to work
3) Participants who are not having chronic low back pain

This study was conducted on 100 patients. Informed consent was taken from the study participants & baseline data was collected. Pre-assessment was done regarding pain, functional status and lumbar muscle endurance and motor control. The participants who are sewing machine operators and having chronic low back pain were enrolled in the study. The individuals taking part in the research were assigned to a group, who received a preset structured physiotherapy protocol for 5 times a week for 30-45 mins; for 6 weeks duration.

PROCEDURE:

This six-month randomized clinical trial was done Karad and used an experimental research design with a sample size of 100 individuals drawn from simple random sampling. The research comprises sewing machine operators who have chronic low back pain. Individuals who are not having chronic low back pain are excluded from the trial.

OUTCOME MEASURES:

1. Pain Intensity

Tool: Numeric Pain Rating Scale (NPRS)

Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), which is a widely used, reliable, and valid tool for measuring subjective pain perception. The NPRS is a self-reported 11-point scale, ranging from 0 to 10, where:

0 indicates “no pain,” and 10 represents “the worst possible pain imaginable.”

- Purpose: To quantify the subjective pain experience.

2. Functional Disability

Tool: Oswestry Disability Index (ODI)

Oswestry Disability Index (ODI), one of the most widely used and validated outcome measures for assessing the degree of disability related to low back pain. The ODI is specifically designed to quantify the impact of back pain on an individual's ability to perform daily activities and to monitor changes in functional status over time.

- Purpose: To assess the impact of back pain on daily functional activities.

3. Lumbar Muscle Endurance & Motor Control

Tool: Prone Plank Test (for endurance)
Pressure Biofeedback Test (for motor control and transverse abdominis activation)

- Purpose: To objectively measure core stability and control improvements.

TREATMENT:

Structured protocol - 5 times a week for approx. 30-45 mins; for 6 weeks duration

The present intervention protocol is designed to compare the effects of Lumbar Stabilization Exercises (LSE) with and without Motor Control Training (MCT) on pain and functional outcomes in individuals with chronic low back pain (CLBP), particularly among sewing machine operators. These individuals are at higher risk for CLBP due to prolonged static sitting postures, repetitive trunk flexion, and poor ergonomic conditions. The protocol is structured over a six-week period, with both intervention groups receiving treatment for five days a week, each session lasting approximately 30–45 minutes. The protocol is divided into three progressive phases.

The first phase (weeks 1- 2) "Activation and Awareness Phase"

The primary goal in this phase is to activate deep stabilizing muscles, including the transversus abdominis and multifidus, and to improve participants' awareness of their neutral spine alignment. Participants in

Group A (LSE only) perform basic core stabilization exercises such as abdominal drawing-in maneuver (ADIM), pelvic tilts in a supine position, bridging exercises with core engagement, and static supported postures. **Group B (LSE + MCT)** performs the same exercises with the addition of motor control strategies using pressure biofeedback devices to ensure proper core muscle engagement. This group also receives functional postural training during simulated sewing tasks to enhance proprioceptive control in job-specific activities.

The second phase (weeks 3-4) "Strengthening and Stability Phase"

This stage focuses on building endurance and stability of the core musculature. Group A progresses to exercises like bridge with alternate leg lifts, side planks, bird-dog (quadruped alternate arm-leg reach), and pelvic bridging on a Swiss ball. In contrast, Group B incorporates all these exercises with motor control cues and pressure biofeedback monitoring to ensure sustained and precise core activation. Additionally, participants in Group B perform functional resistance tasks and stability drills while seated on unstable surfaces such as balance discs, replicating job-related conditions.

The final phase (weeks 5- 6) "Functional Integration Phase"

This stage aimed at translating acquired core control and endurance into work-specific functional movements. Group A engages in dynamic bridging, wall squats with core activation, and standing trunk rotations using resistance bands. Group B complements these exercises with job-simulated training such as sewing with posture correction, trunk-controlled weight shifting in both sitting and standing, and endurance-based functional tasks that reinforce spinal stability during repetitive work movements. This phase is critical in Overall, the interventional protocol is designed to progressively challenge the trunk musculature, enhance motor control, and improve function in a manner that is directly applicable to the occupational demands of sewing machine operators.

RESULT:

Outcome Measure	**Group A *(LSE only)***	**Group B *(LSE + MCT)***
Pain (NPRS)		
Pre-Intervention	6.8 ± 1.2	6.7 ± 1.3
Post-Intervention	4.0 ± 1.1	2.6 ± 0.9
% Reduction	41%	61%
Functional Disability (ODI %)		
Pre-Intervention	46 ± 8%	44 ± 9%
Post-Intervention	30 ± 7%	20 ± 6%
% Reduction	35%	55%
Core Endurance (Plank)		
Pre-Intervention	32 ± 10 sec	30 ± 12 sec
Post-Intervention	48 ± 12 sec	70 ± 14 sec
% Improvement	50%	133%

Interpretation:

Group A (LSE only) shows:

- Moderate improvements in all parameters, but significantly less than Group B

Group B (LSE + MCT) shows:

- Greater reduction in pain (from 6.7 → 2.6)
- Greater functional improvement (ODI reduced by 55%)
- Significantly higher core muscle endurance improvement (from 30s → 70s)

These results indicates that the addition of motor control training enhances the effectiveness of lumbar stabilization exercise by promoting better neuromuscular control, postural correction and functional integration showed notable increases in mean scores from pre- to post-intervention, with all p-values **< 0.001**, indicating a highly significant effect of the intervention.

DISCUSSION:

The findings of this study demonstrates that combining Lumbar Stabilization Exercises (LSE) with Motor Control Training (MCT) yields superior outcomes in the management of chronic low back pain (CLBP) compared to LSE alone. This is particularly relevant for sewing machine operators, a population vulnerable to CLBP due to prolonged sitting, sustained forward flexed posture, and repetitive trunk movements associated with their work.

The results demonstrated a significantly greater reduction in pain intensity, as measured by the Numeric Pain Rating Scale (NPRS), in the group receiving LSE + MCT. This aligns with previous literature suggesting that motor control training enhances deep muscle recruitment (e.g., transversus abdominis, multifidus), which plays a crucial role in spinal stabilization and pain modulation. The use of pressure biofeedback units during MCT may have facilitated more accurate activation of these muscles, contributing to the observed pain relief.

In terms of functional disability, measured by the Oswestry Disability Index (ODI), participants in the combined group also showed greater improvements. These results reflect the ability of MCT to restore coordinated movement patterns and improve trunk control, which is vital for performing everyday activities and occupational tasks. Improved motor coordination and posture likely contributed to reduced mechanical stress on the lumbar spine, thereby enhancing functional capacity.

The study by Jee Hyun Suh showed that lumbar SE and WE significantly improved chronic LBP. WE and stabilization with WE significantly improved muscular endurance of back muscles. Moreover, walking and SEs also improved the core stability. It is also worth noting that patients in the WE and SE groups were much more compliant than those in the other exercise groups. This study suggests that lumbar SE and WE should be recommended to patients with chronic LBP because they help not only to relieve back pain but also to prevent chronic back pain through the improvement of muscle endurance.

CONCLUSION:

This study highlights the effectiveness of lumbar stabilization exercise with or without motor control training on pain and function in individuals with chronic low back pain among sewing machine operators. The significant reduction in pain levels, substantial improvement in functional capacity and marked gains in core stability and endurance suggests that the lumbar stabilization exercise (LSE) with motor control training (MCT) is significantly more effective than LSE alone in reducing pain, improving function and enhancing the core muscle endurance in individuals with chronic low back pain (CLBP) among sewing machine operators.

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