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Effects Of Lumbar Motor Control Training On Non- Specific Chronic Low Back Pain : A Literature Review

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ABSTRACT

Background: Non-specific low back pain is a prevalent musculoskeletal disorder, and it is described as lower back pain and discomfort. The phrase "non-specific" means that pain is not brought on by a particular underlying pathology, but rather has to do with how the spine, muscles, and joints move and function.
Objective: To assess the efficacy of motor control training on people suffering from non-specific chronic low back pain.
Methods: Search Strategy: PubMed, Google Scholar, CINAHL, ScienceDirect, EBSCOhost, and ResearchGate were searched using phrases such as low back pain, chronic non-specific low back pain, motor control training, low load motor control training, motor skill training, and related topics.
Article Selection: Out of the 129 articles that were retrieved, 15 were found to be pertinent following careful examination.
Result: Lumbar motor control exercises (MCEs) are a promising non-pharmacological intervention for adults with low back pain, improving functional limitations, pain intensity, and quality of life by focusing on deep spine stabilizing muscles.
Conclusion: The current review offers robust evidence in favor of MCEs' effectiveness as a secure and reliable LBP treatment option. For adults with LBP, MCEs provide a non-invasive, economical, and long-lastingmethod of pain management and enhanced functional outcomes.
Keywords: low back pain, chronic non-specific low back pain, motor control training, low load motor control training, motor skill training

INTRODUCTION

With an 80% prevalence rate, non-specific low back pain (NSLBP) ranks highest amongst the most prevalent musculoskeletal conditions. The changes which take place in the paraspinals' histomorphology, and structure are linked to chronic low back pain. These back muscles exhibit some degree of atrophic changes in specific muscle fibres, are smaller, and contain fat. As a result, there is excessive fatigability and weakness in the lumbar paraspinals. Strength, mobility, endurance, and functional disability can all be enhanced by exercise.[1]

In addition to lower extremity pain, low back pain is characterized by pain that is localized between the inferior gluteal folds and the costal s. With no known etiology or pathology, non-specific LBP (NSLBP) accounts for more than 85% of cases of LBP. In patients with NSLBP, body equilibrium is undermined, which is crucial for carrying out task-oriented pursuit. In the population afflicted with low back pain (LBP), abnormal muscle recruitment patterns and insufficient

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coordination of muscles which is marked by diminished involvement of core postural muscles, increased activity in surface-level muscles, and restricted flexibility in the spine has the capacity to modify the usual stability of the spinal region.[2]

Exercise-based interventions are widely recognized as an established approach for addressing enduring lumbar discomfort. It is linked to the improvement and prevention of LBP, and leading a continuous active lifestyle is well recognized as a useful tool in preventing chronic lower back pain.[3]

Exercise recommendations for individuals grappling with symptomatic lumbar disc herniation (LDH) frequently encompass motor control exercises (MCEs), stabilization exercises and exercises geared towards improving core stability. The purpose of motor control exercises (MCEs) is to reshape the coordinated activation pattern of the pelvic floor muscles, paraspinals, gluteal, diaphragm, and abdominals. The primary biological justification for MCEs stems from the notion that people suffering from LBP have altered spinal stability and regulation. The first step in an MCE program is to identify the spine's natural position, which is thought to be the position of power and balance. This position marks the center between the lumbar bending and stretching spans of movement. Initially, exercises focused on motor control involve a mild, continual isometric contraction of the muscles stabilizing the trunk, progressively assimilating them into practical activities. The application of MCE typically takes place in individualized supervised therapy sessions. To provide input on the activation of trunk musculature, manual examination, ultrasonic imaging, and/or pressure biofeedback units could also be utilized.[4]

The goal of activities targeting motor control is to improve the operation and synchronization of the deep muscles that uphold the spine. These exercises are started under the supervision of a therapist and then completed on their own. They offer modest relief from moderate pain and a useful advantage for low back pain that is ally more beneficial than regular exercise for low back discomfort.[5]

REVIEW OF LITERATURE

1. **Ibrahim, A.A.** et al (**2023**) conducted a study called ‘Effectiveness of patient education plus motor control exercise versus patient education alone versus motor control exercise alone for rural community-dwelling adults with chronic low back pain: a randomized clinical trial’. It was done with 120 rural dwellers suffering from chronic low back pain (CLBP) with a mean age of 46. They were randomly distributed among three cohorts, each comprising 40 individuals. The 1st arm underwent Patient education plus Motor Control Exercise, the 2nd group underwent only Patient education and 3rd group only motor control exercises. The outcome measures used in the study were NPRS; ODI; SF-12; Physical and mental component summary of SF-36; GRCS; FABQ; PCS; BBQ. Exercises were performed for 8 weeks under supervision. After completion of the study, it was found that PE and MCE significantly improved pain and disability in adults experiencing chronic low back pain (CLBP) residing in rural areas, suggesting the possibility of merging these interventions to promote self-care and reduce the prevalence of CLBP in these under-resourced areas.[6]
2. **Fortin M.** et al. (**2023**) conducted a study namely ‘The Effects of Combined Motor Control and Isolated Extensor Strengthening Versus General Exercise on Paraspinal Muscle Morphology, Composition, and Function in Patients with Chronic Low Back Pain: A Randomized Controlled Trial’ which had 50 individuals who were randomly allocated in two arm the 1st arm underwent motor control training with isolated extensors strengthening and the 2nd group underwent general exercises. The treatment continued for 12 weeks, and outcome measures were

Multifidus muscle morphology and function which was assessed by 3-Tesla General Electric MRI machine and Aixplorer Supersonic ultrasound machine respectively. Morphology of Erector Spinae Muscle was assessed manually. Along with these, SF-12 and ODI were also used. Results showed that Multifidus and Erector spinae CSA, as well as MF thickness improved more in the 1st group. Enhancements in pain management, functionality, and overall quality of life were noted in both groups. Preliminary findings from this study indicate that motor control training with isolated extensors strengthening may enhance paraspinal morphology while reducing pain and disability.[7]

3. **Turci A. M.** et al. (**2023**) conducted a study called 'Self-administered stretching exercises are as effective as motor control exercises for people with chronic non-specific low back pain: a randomized trial' in which 100 individuals suffering from CLBP were randomly assigned into 2 arms. The 1st arm underwent self-administered stretching exercises, and the 2nd group underwent motor control training. The treatment continued for 8 weeks, which included 40 minutes of supervised sessions/week and one or more home sessions/week. The scales or measures used for the assessment were NPRS; ODI; FABQ; fingertip-to-floor test. Post study it was found that the between -group difference in pain intensity, disability and the secondary outcomes were negligible.[8]

4. **Hirota R.** Et al. (**2023**) conducted a study called 'Effects and limitations of home-based motor-control exercise for chronic low back pain: A single centre prospective study' in which 15 patients were made part of the study and divided into 2 groups. The 1st group had 4 participants who had adult spinal deformity (ASD), and the 2nd group had 11 participants without ASD. During the clinic's rehabilitation sessions, the patients received instruction regarding the type and level of exercise prescribed. The patients were told to exercise for 20 minutes a day, at least two times per week, continued for half a year. Evaluation measures used in this study were VAS; locomotor 25; stand-up test; two-step test; trunk and total body muscle mass by the impedance method; and spinal sagittal alignment. In post treatment evaluation it was found that there was significant improvement in pain intensity and in functionality in non-ASD group, however there was none of these changes were seen in ASD group and there was no alteration observed in muscle volume or spinal alignment in either of the cohorts[3]

5. **Lanier V. M.** Et al. (**2023**) conducted a study called 'Treatment preference changes after exposure to treatment in adults with chronic low back pain' in which 83 participants with CLBP were randomized into two arms. The 1st arm had 41 participants and underwent motor skill training (MST) whereas the 2nd group had 42 participants and underwent strength and flexibility exercises (SFE). They were given 6 weekly sessions on 1 hour each, and then they did a 12 month follow up. Participants completed a TPA questionnaire delineating motor skill training (MST) and strength and flexibility exercises (SFE) before commencing treatment. Using a 5-point Likert scale (ranging from 0 to 4), participants rated the effectiveness, acceptability, suitability, and convenience of each treatment option. Higher scores corresponded to higher ratings. Along with these, MODQ and NPRS were recorded as well. Twelve months after treatment, Participants who underwent motor skill training tended to rate their preference for it higher, whereas participants who underwent strength and flexibility exercises tended to rate their preference lower. Additionally, while MST generally led to increased preference ratings regardless of pain levels, smaller improvements in pain resulted in decreased preference ratings in the strength and flexibility group.[9]

6. **Gorji, S.M.** Et al. (**2022**) conducted a study called 'Pain Neuroscience Education and Motor Control Exercises versus Core Stability Exercises on Pain, Disability, and Balance in Women with Chronic Low Back Pain'. This study included 42 individuals with CLBP who fall within the age range of 50 to 60 were randomized into 2 arms of 21 participants each. The 1st arm underwent PNE and MCE and the 2nd arm underwent core stabilizing training (CST) for 8 weeks. The evaluation criteria utilized in this study comprised of VAS; RMDQ; USB; TUG test. Compared to CST treatment, PNE plus MCE treatment was more successful in reducing pain, disability and improving unipedal balance. Nevertheless, it was demonstrated that both treatments were safe and effective in raising all the dependent variables examined in CLBP participants.[10]

7. **Hooker Q. L.** et al. (**2022**) conducted a randomized controlled trial namely 'Motor skill training versus strength and flexibility exercise in people with chronic low back pain: Preplanned analysis of effects on kinematics during a functional activity', in which 154 adults with CLBP were included. They were randomly allocated in 2 groups, including 77 each. 1st group underwent SFE and the 2nd group MST. Patients of the first group were provided with exercises aimed at enhancing trunk strength and flexibility in the lower limbs, while those in the second group received personalized guidance to adapt their modified movement pattern, with this regimen lasting for a duration of 6 weeks. The evaluation tool used in the study in NPRS. The research concluded that MST is more efficacious compared to SFE in improving and sustaining modified movement patterns among individuals suffering from CLBP. MST demonstrated a reduction in early lumbar spine movement and an augmentation in knee and hip joint movement, whereas SFE showed no significant alterations.[11]

8. **Rabiei P.** Et al. (**2021**) conducted a study called 'Comparing Pain Neuroscience Education Followed by Motor Control Exercises with Group-Based Exercises for Chronic Low Back Pain: A Randomized Controlled Trial' in which they incorporated 73 patients with CLBP and then they were assigned randomly into two arms. The arm cohort consisted of 37 patients, and they underwent PNE followed by MCE, whereas the 2nd arm underwent group-based exercises (GE). The interventions were followed for 8 weeks, twice a week. The outcome measures employed in the study were VAS); RMDQ); PSEQ. The study found that PNE and MCE proved to be more efficient compared to GE in diminishing both pain intensity and disability among patients suffering from CLBP, suggesting further research is needed to determine their superiority.[12]

9. **Van Dillen L. R.**, Et al. (**2021**) conducted a study called 'Effect of Motor Skill Training in Functional Activities vs Strength and Flexibility Exercise on Function in People with Chronic Low Back Pain: A Randomized Clinical Trial', which included 154 patients who were suffering from CLBP for over a year and should fall within the age range of 18 to 60. All the individuals were allocated into 4 cohorts: MST alone, MST plus booster, SFE alone, and SFE plus booster groups. Modified Oswestry Disability Questionnaire was used pre and post treatment as an outcome measure. The study shows that, in comparison to conventional strength and flexibility exercise (SFE), Tailored MST focusing on individual needs for LBP associated with restricted functional activities result in more substantial enhancements in function over both short and long durations. Following treatment, the MST and SFE groups showed improvements in function that were clinically significant. Nonetheless, MST showed nearly twice as much function improvement (60% change) as SFE (35% change).[13]

10. **Tsang S. M. H.** Et al. (**2021**) conducted a study called 'Recovery of the lumbopelvic movement and muscle recruitment patterns using motor control exercise program in people with chronic nonspecific low back pain', in which 15 adults with NSLBP and 15 adults without any underlying conditions as control were included. The participants of LBP group were put into a motor control rehabilitation program which lasted for weeks and had 2 sessions per week. The outcome measures used in this study were SBST; TSK; RMDQ; and PSEQ. Along with these, physical outcomes were evaluated through 3D motion and electromyographic analysis while performing repetitive forward bending Manoeuvre.[14]

11. **Songjaroen S.** Et al. (**2021**) conducted a randomize controlled trial called 'Combined neuromuscular electrical stimulation with motor control exercise can improve lumbar multifidus activation in individuals with recurrent low back pain', in which included 60 participants, out of which 35 presented with CLBP while remaining 25 were control. The CLBP group was further randomized into two groups. The 1st group underwent Neuromuscular electric simulation (NMES) plus motor control exercises (MCE) and 2nd group underwent Sham NMES plus MCE. Rehabilitative ultrasound imaging was employed to measure Lumbar multifidus thickness at L4-L5 facet joint during resting, maximum voluntary isometric contraction (MVIC), and a combination of neuromuscular electrical stimulation with MVIC. It was discovered that combining NMES and MCE may improve LM activation in patients more effectively. These results would lend credence to the usefulness of using Neuromuscular electric simulation to create a lasting effect prior to motor control exercises.[15]

12. **Teychenne M.** Et al. (**2019**) conducted a study titled 'General strength and conditioning versus motor control with manual therapy for improving depressive symptoms in chronic low back pain: A randomized feasibility trial', with 40 men and women who were suffering from NSLBP for at least 90 days, having a mean age of 35. They were allocated randomly into 2 cohorts, the initial cohort consisted of 20 individuals who engaged in motor regulation workouts and hands-on therapeutic interventions, while the subsequent group of 20 subjects participated in overall muscle fortification and conditioning. Individuals in the primary cohort were provided with 12, 30-minute physiotherapy sessions for chronic low back pain. Pain education was combined with these exercises, commencing from positions without any load and advancing towards standing and practical movements. The 2nd cohort received instruction on managing pain and engaged in exercise sessions both at the gym and at home. They were obligated to attend two sessions at the gym weekly during the initial three months, succeeded by one or two supervised sessions weekly for the subsequent three months. Exercises included aerobic conditioning, proprioceptive exercises, weight transfer, external perturbation, and progressive resistance training. Outcomes were measured via CES-D 10 and VAS. The study found that adults with chronic NSLBP who received manual therapy, motor control, or general muscle strengthening demonstrated a decrease in depressive symptoms, but additional interventions and a control cohort are necessary[16]

13. **Hides J. A.** Et al. (**2019**) conducted a study called 'Predicting a beneficial response to motor control training in patients with low back pain' in which the reaction of 775 patients with lower back pain to MCT was categorized as either 'enhanced' or 'unchanged', determined by self-reported alterations in pain intensity and symptoms. The outcome measures were used in the study were VAS; RMDQ; HAQ; and The

LOGIQe system was employed to measure the fragmentary area of the lumbar multifidus muscle with the help of ultrasound imaging. Patients with scoliosis, low back pain without groin pain, chronic recurrent LBP, and subpar multifidus muscle test results showed positive responses to the treatment. A separate sample test verified that patients could be sorted into groups experiencing benefits, confirming the effectiveness of the treatment. The first step in helping clinicians choose patients who will respond best to MCT is provided by this study.[17]

14. **França F. J. R.** Et al. (**2019**) conducted a randomized controlled trial titled 'Motor Control Training Compared with Transcutaneous Electrical Nerve Stimulation in Patients with Disc Herniation with Associated Radiculopathy', wherein 40 patients with lumbar disc herniation were segregated into two cohorts. The initial cohort had 20 individuals and underwent MCT, on the other hand the 2nd cohort also had 20 individuals, but those were given transcutaneous electrical nerve stimulation (TENS) as the treatment option. The intervention in both groups lasted 8 weeks, twice a week, resulting in 16 sessions lasting 60 minutes each. The outcome measures used in the RCT were VAS; MPQ; ODI; and PBU was used for assessing transversus abdominis activation capacity. The results suggest that among individuals with LDH, MCT is superior to TENS in terms of pain relief, functional impairment reduction, and transversus abdominis activation.[18]

15. **Halliday M. H.** Et al. (**2019**) conducted a study called 'A randomized clinical trial comparing the McKenzie method and motor control exercises in people with chronic low back pain and a directional preference: 1-year follow-up', in which 70 participants with CLBP were randomly allocated into 2 cohorts with 35 each. The 1st cohort underwent McKenzie method and 2nd group underwent motor control exercises. They were given 12 sessions of treatment spread over 8 weeks. The outcome measures for this study were thickness of transverse abdominis, obliquus internus and obliques external muscle. Along with these outcomes' PSFC; GPQ; and 11-point VAS. There were no significant differences observed between the cohorts in terms of changes in thickness of trunk muscles for any of the three muscles under observation, nor in the secondary outcomes of function, perceived improvement, and discomfort.[19]

METHODOLOGY

Study type : Literature review
Study setting : School of Allied Health Sciences, Sharda University

Inclusion Criteria

- Articles published in or after 2019
- Randomized Controlled trials
- Cohort studies
- Prospective studies

Exclusion Criteria

- Articles published in or before 2018
- Systemic Reviews
- Case control studies
- Articles without abstract or full English text

RESULT

After fifteen research were reviewed, it was shown that individuals with chronic low back pain (CLBP) can significantly reduce their pain and impairment by using motor control training (MCT). Muscle morphology and functioning were markedly improved by combining MCT with either solitary extensor strengthening exercises or patient education. Lumbar multifidus activation improved when neuromuscular electrical stimulation and

MCT were combined. The adaptability of MCT was demonstrated by comparisons between self-administered stretching exercises and MCT, which revealed insignificant variations in pain intensity and disability results. Compared to typical

strength and flexibility exercises, personalised MCT treatments produced better pain control and higher treatment preference ratings, indicating the necessity for individualized therapy techniques.

CONCLUSION

Motor control training (MCT) is a highly effective intervention for managing chronic low back pain (CLBP), especially when personalized and combined with other therapeutic approaches. The review highlights MCT's flexibility in accommodating various patient preferences and its significant impact on pain reduction and functional improvement. Integrating MCT into standard CLBP management protocols is recommended to optimize patient outcomes.

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