

Original Research Article

Effect Of Movement Control Spinal Exercise Programme On Pain And Mobility In Individual With Non-Specific Low Back Pain.

Abstract:

Background: Low back pain is the most common condition that affects the majority of the population with up to 84% lifetime prevalence. A specific diagnosis of low back pain is only possible in 15% of patients and ~~in the~~ majority of cases the pain is non – specific low back pain (NSLBP). The main objectives were to assess the effect of movement control spinal exercises (MVCSE) on NSLBP and to examine the effect of MCSE on mobility.

Method: The study was conducted in the physiotherapy out-patient department. After screening of the inclusion and exclusion criteria, 35 individuals with NSLBP were selected. ~~Pre~~A pre-test assessment was done, and then the exercise programme was conducted for a total of 6 weeks with one session of 1 hour per day. Later the ~~post-post~~-test assessment was done and further statistical analysis was done.

Results: After 6 weeks post evaluation, patients with flexion movement control impairment (MVCI) had improvement in their movement control; extension, lateral and rotational movement control impairments were the same as before.

Conclusion: The ~~patient-patient~~-specific functional complaints and disabilities improved significantly after implementation of the individual based specific exercise programme, along with the regular physiotherapeutic interventions. MVCSE treatment is more effective in improving mobility and disability in the short term and long term for individuals with NSLBP and MVCI ~~to than~~ other interventions.

Keywords: Mechanical low back pain, mobility, disability, abnormal tissue loading.

Comment [SG1]: Write little about exercise program in abstract also.

Comment [SG2]: Do not use abrivations in the abstract

Introduction:

Low back pain (LBP) is a common and very costly health problem; it is often associated with high recurrence rates and equivocal management efficacy. Waddell has defined it as "a pain that arises from the lower part of the spine, i.e. between the 12th thoracic vertebra and the 1st sacral vertebra, it can be local but also can radiate towards the lower extremity. Dionne et al. has suggested that, even if it is minimally present, it is bad enough to limit your usual activities or changes in the daily routine for more than one day^[1]. It is a common condition that affects the majority of the population with up to 84% of lifetime prevalence. A specific diagnosis of low back pain is only possible in 15% of patients and in the majority of cases, the pain is non-specific in nature.^[3] Non-specific low back pain (NSLBP) is- the type of low back pain that has no specific anatomical cause, mostly it is associated with an alteration of the spinal alignment and also in the movement patterns in any specific direction; which is also known as movement control impairment (MVCI)^[4]. Patients with MVCI have painfully restricted movements. They mainly complain of the increase in pain during certain positions like sitting, standing or in twisted positions. MVCI is direction-specific, it can be provoked either by flexion, extension, rotation or multidirectional movements.^[5] Up to ~~one~~ ~~one~~-third of patients with LBP are estimated to have MVCI These impairments can occur secondarily to the presence of pain, due to abnormal tissue loading, lack of proprioceptive awareness and also lack of withdrawal reflex motor response. Hence, this confirms that 90% of LBP ~~are~~ ~~is~~ related to unspecified causes. In other literatures, it has been reported that the weakened abdominals, back muscles, poorly stretched muscles, incorrect posture, obesity, strained muscles from incorrect body mechanics can often results in NSLBP.

Comment [SG3]: Rephrases the sentence

Comment [SG4]: Put the end double quote also

NSLBP treatment represents one of the toughest challenges of modern health-care as it is very expensive to diagnose it. Improving the assessment and treatment skills these subjects need to be identified in ~~to~~ various subgroups. The model given by O' Sullivan for the LBP classification of various sub-groups which is purely based on the underlying mechanism of the disorder was considered for this study.^[6] According to him LBP can be either centrally or peripherally evoked. The centrally evoked pain ~~is~~ ~~accompanies~~ the psychosocial factors, such as fear avoidance, ~~eatastrophising~~ ~~catastrophizing~~ or depressive mood (approximately 30% of patients with LBP suffer from this kind of NSLBP). On the other hand, peripherally evoked LBP is truly mechanically caused and is further divided into movement impairment and MVCI (each approximately 30%).^[7,8] A ~~patient~~ ~~patient~~-specific tailor-made, more efficient treatment should be highly implemented to ensure appropriate management of the disorder.^[9] The main aim of the treatment was to restore movement control, ~~to~~ correct the movement patterns and to avoid the pain-provoking postures that would be beneficial in improving the patient's well-being.

Comment [SG5]: Re phrase the sentence.

Comment [SG6]: Re write the sentence

Comment [SG7]: What is the aim of the study? What are the objectives? With the introduction written by the author it is not clear why this study is needed? What are its aims and objectives?
Author has written theory about LBP and other things but there is lack of academic writing to fully describe the purpose/ need of the study. Re write the whole introduction

Comment [SG8]: How this sample was calculated?

Comment [SG9]: Where this bracket ends?

Comment [SG10]: Why is criteria? Either give rational or add reference to it

Methodology:

Study Design: Experimental Study.

Participants: A total of 35 participants individuals within the age group of aged between 20 to 60 years, with non- acute LBP (duration- > 6 weeks but less than 3 months of the symptoms), individuals who presented with two more positive tests for MVCI and also

had aggravated symptoms while attaining any posture or movement of the back were considered in this study.

Individuals having specific LBP (secondary to fractures, carcinoma, nerve root affection with neurological involvement e.g.: sensitivity or reflex loss, muscular weakness, radicular pain below the knee), post-operative cases of the spine, high level of psychological risk factors (>130 points on OMPQ), peripheral or central neurological disease and psychological or psychiatric problems, major cardiovascular disease or postural hypotension, chronic drug and alcohol abusers, individuals consuming medications like, neuroleptics, sedatives, anti-epileptics and anti-depressants.^[10]

Comment [SG11]: OMPQ ??

Procedure: This research study was presented to the Institutional ethics committee of Krishna Institute of Medical Sciences "Deemed to be" University, Karad and it was conducted at Krishna Hospital in Karad, Maharashtra. Concerned Participants that were required for the study were approached and the purpose of the study was explained to them. A Written clear consent was taken from every individual; they were given a clear explanation about the whole procedure. Outcome measures used were Modified Oswestry Disability Index, Patient-Specific Functional Scale, Movement Control Test, and Numerical Pain Rating Scale. Pre pre-test assessment was done with the outcome measures and the exercises were performed accordingly. The whole session was of duration between 45 minutes to 1 hour for 6 weeks. For each exercise session, the individual was asked to expose the lower back and an adhesive tape was applied over the lumbar region (T12 – S1) and it began with a warm-warm-up, further progressed with exercises, and ended with cool down up session. Later post- test assessment was done. After the collection of the data, all the details were shown to the statistician for further statistical analysis.

Comment [SG12]: What was the method of sampling?

Physiotherapy Intervention:^[3,4]

1. Exercises for Flexion impairment:

- a. Waiters bow: Bend forward from the hips only and don't move your back
- b. Squatting: Place a chair against your knee, so that your knees don't slide forward, push your pelvic backwards.
- c. Sitting knee extension: Sit in an upright position with legs dangling downwards, ask the patient to extend the knee without moving the spine.
- d. Lunge forward: Ask the individual to move one leg ahead and flex the knee, don't let the spine move.
- e. Quadruped position: Ask the patient to go in the quadruped position and to move the spine forward.

Comment [SG13]: Change the writing style which is appropriate with manuscript writing

2. Exercises for extension impairment:

- a. Pelvic tilt: This exercise can be performed in standing without support or with support against the wall (command- tilt your pelvis backwards), also in supine lying or in prone (command- relax yourself in flexion position and take deep breathes).

Statistical Analysis: (Tables/Interpretations)

The movement control was assessed prior and post the treatment series. The collected data in this study ~~was~~ were statistically analyzed using descriptive statistics. Percentages of mean changes were calculated, as well as standard deviations and confidence intervals. Paired t- test was used for parametric data, and Wilcoxon rank test for non- parametric data and Mann Whitney U. The data was analyzed with SPSS 14.0 for Windows. For the sample size the Cochran formula was performed on the acquired data.

Objective 1: To assess the effect of movement control spinal exercises on non- specific low back pain.

Table 1: Descriptive for difference between pre and post test score of pain based on numerical rating scale

	Pre-test score		Post test score		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Numerical rating scale	8.286	1.100	2.314	1.051	<0.0001

Comment [SG14]: Round of the values to one point after decimal

The mean and standard deviation values in pre and post test of pain on numerical rating scale, receiving movement control spinal exercises are pre- test (8.28± 1.10) and post- test (2.31± 1.05).

Table 2: Descriptive for difference between pre and post test score of pain based on modified oswestry disability index

Modified Oswestry-Oswestry disability index	Pre-test score		Post-Post-test score		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
	24.857	4.948	11.686	3.554	

The mean and standard deviation for pain pre and post on modified Oswestry-Oswestry disability index are 24.85 ± 4.948 pre- test and 11.68 ± 3.55 post-test.

Objective 2: To examine the effectiveness of movement control spinal exercises on mobility.

Table 3: Descriptive for the difference between pre and post-test score of pain based on a patient-specific functional scale

PSFS	Pre-Pre-test score		Post-Post-test score		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Standing	5.257	3.156	1.886	1.409	<0.0001
Walking	1.971	2.640	0.543	1.010	<0.0001
Sitting	0.657	1.413	0.171	0.514	<0.0001

The mean and standard deviation for pain pre and post on patient-specific functional scale are for standing walking and sitting. In pre- test standing (1.25 ± 3.15), walking (1.97 ± 2.64), sitting (0.65 ± 1.41) while in post- test standing (1.88 ± 1.409), walking (0.54 ± 1.01), sitting (0.17 ± 0.514).

Table 4: Descriptive for difference between pre and post test score of pain based on movement control test.

MCT	Pre test score		Post test score		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Waiters bow	0.714	0.458	0.257	0.443	0.000
Pelvic tilt	0.171	0.382	0.057	0.236	0.102

One leg stance	0.171	0.382	0.086	0.284	0.083
Quadruped position	0.629	0.490	0.286	0.458	0.014
Prone lying active knee flexion	0.457	0.505	0.257	0.443	0.001
Sitting knee extension	0.371	0.490	0.200	0.406	0.008

The mean and standard deviation for pain pre and post on movement control test, ~~the~~-test included six tests. Pre-Pre-test waiters bow (0.71 ± 0.45), pelvic tilt (0.17 ± 0.38), one leg stance (0.17 ± 0.38), quadruped position (0.62 ± 0.49), prone lying active knee flexion (0.45 ± 0.50), sitting knee extension (0.37 ± 0.49). Post-Post-test waiters bow (0.25 ± 0.44), pelvic tilt (0.05 ± 0.23), one leg stance (0.08 ± 0.28), quadruped position (0.28 ± 0.45), prone lying active knee flexion (0.25 ± 0.44), sitting knee extension (0.20 ± 0.40).

Table 5: Descriptive for gender-gender-based on post-post-test score of pain scales

	Mean	Std. Deviation	p-value
Gender	1.543	0.505	0.288
Numerical rating scale	2.314	1.051	0.504
Modified Oswestry disability index-	11.686	3.554	0.379
PSFS- Standing	1.886	1.409	0.983
PSFS-Walking	0.543	1.010	0.418
PSFS- Sitting	0.171	0.514	0.394
MCT- Waiters bow	0.257	0.443	0.118
MCT- Pelvic tilt	0.057	0.236	0.052
MCT- One leg stance left	0.086	0.284	0.316
MCT- Quadruped position	0.200	0.406	0.751
MCT- Prone lying active knee Flexion	0.286	0.458	0.394
MCT- Sitting knee extension	0.257	0.443	0.482

Result:

Among the 35 individuals with NSLBP, 16 were male and 19 were female. After 6 weeks of ~~post-post~~-evaluation, statistical analysis was done. In patients with flexion movement control impairment, there was a significant improvement in the movement control, and it was same with extension, lateral and rotational movement control impairment. Our study states a-preliminary evidence to show that movement control can be improved through specific exercises and gives an indication for reduction of the pain and improvement in the mobility.

Discussion:

The aim of this study was to evaluate for the effect of the Movement Control Spinal Exercise Programme on Pain and Mobility in Individual with non-specific low back pain. The main study question was whether this type of exercise programme is more effective in reducing disabilities associated with LBP. The observed improvement in MC was accompanied by decreased functional experienced pain and disability in patients with NSLBP pain. The biggest effect was shown in the improvement of movement control ability. Patients with movement impairment have a painful restriction of movement; patients with movement control impairment have complaints in certain positions, such as sitting, standing, or in twisted positions. Movement control impairment is ~~direction~~ direction-specific, either provoked by flexion, extension, rotation, or multidirectional movements.^[5] We used four outcome measures out of which the test battery of six tests for which acceptable reliability has been demonstrated in previous research, were they evaluated with ten movement control tests.^[11,12,13] We refrained from testing six movements in random order because we assume that this procedure best represents clinical practice where routines are often developed.^[14] The procedure has the advantage that the chance of behavioral response being altered by differences in prior test history decreases.

There was a limitation for the procedure; however, we were unable to define whether the order of testing influences patients' performances on subsequent tests. The validity of the six-~~direction~~ direction-specific test in this study is supported by the following considerations. The test "waiter's bow", "sitting knee extension" and "rocking on all four backwards" assess flexion movement control. The test where hip flexion is expected while the lumbar spine is stabilized, ~~are-is~~ are-is positive in the lumbar spine occurs. Similarly, extension movement control assessed in the tests "pelvic tilt", "rocking all four forwards", and "prone knee bending" where the subjects should extend the hip while the lumbar spine stabilized.^[15] The "one leg stance" test is testing lateral flexion and rotation

Comment [SG15]: Results heading is misplaced in the manuscript

Comment [SG16]: Re write the sentence

Comment [SG17]: how can you say more effective, this study was not a comparison study.

Comment [SG18]: ?? what is MC

control. During lateral weight shift, abduction and adduction in the hip joints should occur in the hips while the lumbar spine maintains a neutral position.^[16]

Positive studies involved defined clinical subgroups. Benefits of specific exercise were demonstrated in other subgroups of patients with LBP. Specific stabilizing exercises are more effective than general exercises.^[10,11] Brennan et al (2006) showed that the outcomes are better if patients receive treatment adapted to their clinical presentation. Treatment options in this study, specific individual movement control spinal exercises during a six-week intervention, therapies matched to the patients' clinical problems were more effective in the short and long term.^[12] There is ~~an~~ evidence to indicate that patients with movement control deficits are an important subgroup of LBP and that they may benefit from specific exercises. Only about 10-15% of patients can be diagnosed with specific LBP.^[1,2]

O'Sullivan developed a classification system of LBP; the first distinction is between centrally evoked and peripherally evoked LBP. The centrally evoked pain is associated with psychological factors, such as fear avoidance, ~~catastrophising-catastrophizing~~ or depressive mood (approximately 30% of LBP patients).^[11] The peripherally evoked LBP is mechanically caused and includes movement impairment (each approximately 30%). There is strong evidence that psychosocial issues, such as ~~fear-fear~~-avoidance or catastrophising are the most pertinent factors leading to chronicity, yet we did measure any of these properties.^[17] European clinical guidelines for the management of chronic low back pain recommends that more research is required to develop tools to improve the classification and identification of specific clinical sub-group of the chronic low back pain patient.^[18]

Conclusion:

The ~~patient-patient~~-specific functional complaints and disabilities improved significantly after the implementation of the individual based specific exercise programme, along with the regular physiotherapeutic interventions. MVCSE treatment is more effective in improving mobility and disability in the short term and long term for individuals with NSLBP and MVCI ~~to~~-than other interventions.

Ethical Clearance:

The study was approved by the Institutional Ethics Committee of KIMS DU.

References:

1. Luomajoki, H., 2010. Movement control impairment as a sub-group of non-specific low back pain: evaluation of movement control test battery as a practical tool in the

diagnosis of movement control impairment and treatment of this dysfunction (Doctoral dissertation, Itä-Suomen yliopisto).

2. Lehtola, V., Luomajoki, H., Leinonen, V., Gibbons, S. and Airaksinen, O., 2012. Efficacy of movement control exercises versus general exercises on recurrent sub-acute nonspecific low back pain in a sub-group of patients with movement control dysfunction. Protocol of a randomized controlled trial. *BMC musculoskeletal disorders*, 13(1), pp.1-9.
3. Luomajoki, H., Kool, J., De Bruin, E.D. and Airaksinen, O., 2010. Improvement in low back movement control, decreased pain and disability, resulting from specific exercise intervention. *BMC Sports Science, Medicine and Rehabilitation*, 2(1), pp.1-7.
4. Luomajoki, H.A., Beltran, M.B.B., Careddu, S. and Bauer, C.M., 2018. Effectiveness of movement control exercise on patients with non-specific low back pain and movement control impairment: a systematic review and meta-analysis. *Musculoskeletal Science and Practice*, 36, pp.1-11.
5. Carlsson, H. and Rasmussen-Barr, E., 2013. Clinical screening tests for assessing movement control in non-specific low-back pain. A systematic review of intra-and inter-observer reliability studies. *Manual therapy*, 18(2), pp.103-110.
6. O'Sullivan, P., 2005. Diagnosis and classification of chronic low back pain disorders: maladaptive movement and motor control impairments as underlying mechanism. *Manual therapy*, 10(4), pp.242-255.
7. Dankaerts, W., O'sullivan, P.B., Straker, L.M., Burnett, A.F. and Skouen, J.S., 2006. The inter-examiner reliability of a classification method for non-specific chronic low back pain patients with motor control impairment. *Manual therapy*, 11(1), pp.28-39.
8. Luomajoki, H., Kool, J., De Bruin, E.D. and Airaksinen, O., 2008. Movement control tests of the low back; evaluation of the difference between patients with low back pain and healthy controls. *BMC musculoskeletal disorders*, 9(1), pp.1-12.
9. Saner, J., Kool, J., De Bie, R.A., Sieben, J.M. and Luomajoki, H., 2011. Movement control exercise versus general exercise to reduce disability in patients with low back pain and movement control impairment. A randomised controlled trial. *BMC musculoskeletal disorders*, 12(1), pp.1-8.
10. Strand, L.I., Moe-Nilssen, R. and Ljunggren, A.E., 2002. Back Performance Scale for the assessment of mobility-related activities in people with back pain. *Physical therapy*, 82(12), pp.1213-1223.
11. Fersum, K.V., O'Sullivan, P.B., Kvåle, A. and Skouen, J.S., 2009. Inter-examiner reliability of a classification system for patients with non-specific low back pain. *Manual Therapy*, 14(5), pp.555-561.
12. Luomajoki, H., Kool, J., De Bruin, E.D. and Airaksinen, O., 2008. Movement control tests of the low back; evaluation of the difference between patients with low back pain and healthy controls. *BMC musculoskeletal disorders*, 9(1), pp.1-12.

13. Luomajoki, H., Kool, J., De Bruin, E.D. and Airaksinen, O., 2007. Reliability of movement control tests in the lumbar spine. *BMC musculoskeletal disorders*, 8(1), pp.1-11.
14. Sahrman, S., 2001. *Diagnosis and treatment of movement impairment syndromes*. Elsevier Health Sciences.
15. Stratford, P., Gill, C., Westaway, M. and Binkley, J., 1995. Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy canada*, 47(4), pp.258-263.
16. Fairbank, J.C., Couper, J., Davies, J.B. and O'brien, J.P., 1980. The Oswestry low back pain disability questionnaire. *Physiotherapy*, 66(8), pp.271-273.
17. Brennan, G.P., Fritz, J.M., Hunter, S.J., Thackeray, A., Delitto, A. and Erhard, R.E., 2006. Identifying subgroups of patients with acute/subacute "nonspecific" low back pain: results of a randomized clinical trial. *Spine*, 31(6), pp.623-631.
18. Beurskens, A.J., Henrica, C., Kökeb, A.J., Lindeman, E., van der Heijden, G.J., Regtope, W. and Knipschild, P.G., 1999. A patient-specific approach for measuring functional status in low back pain. *Journal of manipulative and physiological therapeutics*, 22(3), pp.144-148.