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Effect of Movement Control Spinal Exercise Programme on Pain and Mobility in Individual with Non-Specific Low Back Pain

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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 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.
Methods: The study was conducted in the physiotherapy out-patient department. After screening of the inclusion and exclusion criteria, 35 individuals with NSLBP were selected. A pre-test assessment was done, the protocol included warmup sessions, exercise protocol and cool down sessions. Exercises were demonstrated to the patients according to the spinal movements control impairment, the total duration of the protocol was of 6 weeks with one session of 1 hour per day. Later the post- test assessment was done and further statistical analysis was done.

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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- specific functional complaints and disabilities improved significantly after implementation of the individual based specific exercise programme, along with the regular physiotherapeutic interventions. Movement Control Spinal Exercise treatment has shown results 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.

1. INTRODUCTION

At the present times there is an epidemic of low back pain in most industrialized countries, it has become one of the biggest problems of public health systems. The exact origin of pain is unknown, and probably many structures can play a role. 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 [2]. 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) [3]. Patients with MVCI have painfully restricted movements. They mainly complaint of 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 [4]. Up to 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 is related to unspecified causes. In some of the literatures, NSLBP is a frequent out- turn of the weakened abdominals, back muscles, poorly stretched muscles, incorrect posture, obesity, strained muscles from incorrect body mechanics.

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 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 [5]. According to him LBP can be either centrally or peripherally evoked. The centrally evoked pain accompanies the psychosocial factors, such as fear avoidance, 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%) [6,7]. A patient- specific tailor-made, more efficient treatment should be highly implemented to ensure appropriate management of the disorder [8]. The main aim of the treatment was to restore movement control, to correct the movement patterns and avoid the pain– provoking postures that would be beneficial in improving the patient's well-being.

2. METHODOLOGY

2.1 Study Design: Experimental Study

Participants: A total of 35 participants aged between 20 to 60 years, with non- acute LBP (duration- > 6 weeks but less than 3 months of the symptoms) [9], 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 Orebro Musculoskeletal Pain Questionnaire), peripheral or central neurological disease and psychological or psychiatric problems, major cardiovascular disease or postural hypotension, chronic drug and alcohol abusers, individuals consuming medications[10].

Procedure: The study 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. 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. A 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 per day 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- 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.

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 backward.
   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.

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.
   b. Prone lying active knee flexion: patient in prone lying ask to bend the knee, to advance the exercise keep a pillow under ASIS ask to flex the knee.

3. Exercises for rotation and lateral flexion control impairment:

   a. One leg stance: patient in standing, ask him to raise one leg and keep the pelvis in neutral.
   b. Side bend

2.2 Statistical Analysis: (Tables/ Interpretations)

The movement control was assessed prior and post the treatment series. The collected data in this study 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 Cochrane formula was performed on the acquired data.

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

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

Numerical rating scale	Pre-test score		Post test score		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
	8.3	1.100	2.314	1.051	<0.0001

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

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

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

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

Table 5. Descriptive chart for based on 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

The mean and standard deviation for pain pre and post on Modified Oswestry disability index is a pre- test (24.85± 4.948) and post- test (11.68± 3.55).

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

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).

The mean and standard deviation for pain pre and post on movement control test, the test included six tests. 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- 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).

3. RESULTS

Among the 35 individuals with NSLBP 16 were male and 19 were female. After 6 weeks of 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 revealed that movement control can be improved through specific exercises and gives an indication for reduction of the pain and improvement in the mobility.

4. 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 movement control spinal exercises had effect in reducing disabilities associated with LBP. The observed improvement in movement control 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 specific, either provoked by flexion, extension, rotation or multidirectional movements [4]. 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 specific test in this study is supported by the following considerations. The test "waiter's bow", "sitting knee extension" and "rocking on all four backward" assess flexion movement control. The test where hip flexion is expected while the lumbar spine is stabilized, 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 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 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, 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 avoidance or catastrophizing 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].

5. CONCLUSION

The 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 has shown results in improving mobility and disability in the short term and long term for individuals with NSLBP and MVCI.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee of KIMSDU.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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