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Effectiveness of Movement Control Exercise and Core Stability Exercise on Reducing Pain, Improving Range of Motion and Functional Activities in Patients with Mechanical Low Back Pain

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ABSTRACT

Study Design: Experimental study pretest-posttest design with comparative treatment.
Summary of background: Low back pain is a common condition that affects the Most people at some point of their lives with up to an 84%lifetime prevalence. Mechanical low back pain may be due to faulty posture sedentary lifestyle and improper ergonomics. Core muscles maintain the stability of the lumbar spine. Due to improper mechanics of the spine, there leads muscle imbalance in the lumbar spine. Thus, the rehabilitation of the core muscle results in improving the muscular control around the lumbar spine to maintain functional stability of the spine during activities. Movement control exercises are aimed to identify the Kinesio pathological models of movement dysfunction of the spine. Based on the principle, the treatment aimed to correct and restore the movement pattern and avoiding the posture which provokes them.
Objective: This study is to investigate the effectiveness of movement control exercise and core stability exercise on reducing pain, improving range of motion and functional activities in patients with mechanical low back pain. The primary outcomes include pain intensity and Functional disability. The secondary outcome includes lumbar range of motion.
Study Setting: Department of Orthopedics, Neurology and Physical Medicine & Rehabilitation PSG hospitals, Coimbatore.
Participants: A total of 32 individuals with mechanical LBP participated in the study.
Intervention: Included individuals were randomly assigned to receive 2 weeks treatment Program on movement control exercise and core stability exercise.
Measurements: Pain intensity measured by NPRS, functional disability by Modified ODI And lumbar ROM by MMST.
Results: Subjects receiving movement control exercise showed greater change on pain Intensity, functional disability, and lumbar ROM at p value <0.05 after 2 weeks of intervention than comparing with core stability exercise.

Conclusion: So, we conclude that the movement control exercise is effective on reducing pain, improving range of motion and functional activities in patients with mechanical low back pain compared to core stability exercise.

Keywords: Mechanical Low Back Pain, Modified Oswestry Disability Index, Numerical Pain Rating Scale, Movement Control Exercise, Core Stability Exercise, Un Controlled Motion, Non-Specific Low Back Pain, Lumbar Flexion, Lumbar Extension Significant.

INTRODUCTION

Low back pain is a common condition that affects the most people at some point of them Lives with up to an 84%life time prevalence [(1).] Low back pain (LBP) is the most prevalent of all musculoskeletal conditions and one of the primary reasons an individual visits a primary care physician. Low back pain is a multidimensional approach, consisting of pathoanatomical, neurophysiological, physical and psychological factor [(2).] Mechanical low back pain is described as musculoskeletal pain which varies with Physical activity and not involving root compression or any serious spinal disease usually Unilateral low back pain is classified as acute, sub-acute or chronic according to the duration of symptoms [(3).] Mechanical low back pain is generally term that refers to any type of back pain caused by placing abnormal stress on muscles of vertebral column. Patients with mechanical low back pain typically present with pain at posterior beltline [(4)] and intermittent pain during the day, pain that develops later in the day, pain on standing for a while, with lifting, bending forward a little, on trunk flexion or extension, doing a sit up, when driving long distances, getting out of a chair, and pain on repetitive bending, running, coughing or sneezing were all generally considered as moderate indicators of MLBP [(5).] Core muscles maintain the stability of the lumbar spine. Due to improper mechanics of the spine there leads muscle imbalance in the lumbar spine. Stability of the core requires both Passive (bony and ligamentous structures) and dynamic (coordinated muscular contractions) stiffness [(6).] A bony spine without the contributions of the muscular system is unable to bear essential compressive loads associated with normal upright activities and remain stable [(6).] Core stability training is a form of training that challenges the stability of the spine while training muscle activity patterns and postures that ensure sufficient stability without unnecessarily overloading tissue. Exercises are based on co-contraction of the abdominal and multifidus muscles and they are also performed in a variety of body positions [(7).] Core strengthening has become a major trend in rehabilitation Thus, the rehabilitation of the core muscle results in improving the muscular control around the lumbar spine to maintain functional stability of the spine during activities. Movement control exercises are aimed to identify the kinesio pathological models of movement dysfunction of the spine. Movement dysfunction represents multifaceted problems in the movement system and the therapist needs the tools to relate Un Controlled Motion (UCM) and faults in the movement system to symptoms, recurrence of symptoms and disability [(8).] Skills are required to analyses movement, make a clinical diagnosis of movement faults and apply a patient specific retraining program and management plan to deal with pain, disability, recurrence of pain and dysfunction [(8).]

A common feature of movement control faults is reduced control of active movements, or Movement Control Dysfunction (MCD). The MCD is identified by a series of clinical tests.

These tests have been shown to be reliable in the lumbar spine and have been promoted in clinical practice. The tests are based on

the concept known as dissociation, defined as the inability to control motion at one segment while concurrently producing an active movement at another joint segment [8].
UCM is defined as a lack of efficient active recruitment of the local or global muscle's ability to control motion at a particular motion segment in a specific direction [8].
The development of UCM may have several contributing factors:

1. Compensation for restriction to maintain function.

Restriction → Compensation → UCM → Pathology →Pain

2. Direct over facilitation

Over pull vs under pull → Compensation → UCM →Pathology → Pain

3. Sustained passive postural positioning.

Postural strain → UCM → Pathology → Pain

4. Trauma

Trauma → UCM → Pathology → Pain
Based on the principle, the treatment aimed to correct and restore the movement.

MATERIALS & METHODS

It is a, Experimental study Pretest – posttest design with comparative treatment.
The study was conducted in the Department of Orthopedics, Neurology & Department of Physical Medicine and Rehabilitation, PSG hospitals, Coimbatore during the period of June 2019- December 2019. The study was reviewed and approved by Institutional Human Ethics Committee at PSG IMSR, Coimbatore. Ethical Register no:PSG/IHEC/2019/Appr/FB/029.
32 Individuals with mechanical Low back pain, age group ranging from 20-50 years were participated. Based on the selection criteria individuals were randomly assigned into two groups by simple random sampling method by computer software generated random.
Group A: Movement Control Exercise for mechanical low back pain.
Group B: Core Stability Exercise for mechanical low back pain.
Simple random sampling computer software generate random version 4.0.
The Inclusion criteria: Mechanical low back pain age 20-50 years, Both male and female, positive impaired movement control tests, those who give consent Symptoms aggravate by posture and movement. The exclusion criteria are Past history of fractures (spine, rib) or injury, Past history of abdominal surgery, Spinal or disc pathology, Recent history of trauma,
History of malignancy, Neurological symptoms such as weakness of the limbs,
Contraindication for exercise.eg major cardio vascular disease, (or) postural hypotension. The Total duration of 10 months was adopted for this study.
Treatment Duration: 45mins / session, 1 session/ day for 5 days in a week for 2 weeks.

GROUP-A
MOVEMENT CONTROL EXERCISE
Movement Control Exercise 45mins / session, 1 session/ day for 5 days in a week for 2 weeks.

GROUP-B
CORE STABILITY
Core Stability Exercise 45mins / session, 1 session/ day for 5 days in a week for 2 weeks.
The outcomes were measured using Numerical Pain Rating Scale (NPRS) for measuring disability of Mechanical Low Back Pain intensity, Modified Oswestry low back pain Disability Index (Modified ODI) for measuring, functional disability of Mechanical low back. Modified Modified Schober's Test (MMST) for measuring Lumbar Flexion & extension ROM.
After obtaining the informed consent Initial assessment was taken on the first day of intervention by using outcome measures. The Intervention was given to each group separately for 2 weeks. Final assessment was taken after 2 weeks of treatment using same outcome measures.

DATA ANALYSIS AND INTERPRETATION

Data analysis is the systemic organization and synthesis of research data and testing of research hypothesis using these data. Interpretation is the process of making sense of the results of a study and examining the implication (Polit& Beck, 2004).

The pretest and posttest values for Groups A& B were obtained before and after intervention. The pain reduction and improvement in disability and range of motion were measured using Numerical Pain Rating Scale [NPRS], Modified Oswestry Disability Index and Modified Schober's test.

The mean, standard deviation and paired' test values were used to find out whether there was any significant difference between pretest and posttest values within the groups. Statistical analysis for the present study was done using SPSS (version 16.0).

TABLE: 1. MEAN, MEAN DIFFERENCE, STANDARD DEVIATION AND PAIRED t TEST VALUES OF NPRS FOR GROUPS A & B

Groups	Means (cms)	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A Pre-Test	6.00	4.19	1.04	16	p<0.05
Group A Post-Test	1.81				
Group B Pre-Test	6.38	2.19	.91	9.6	p<0.05
Group B Post-Test	4.19				

Based on Table 1, the mean difference of group A was found to be 4.19, Standard deviation was 1.04; the 't' value using the paired 't' score was 16.0 which was greater than the table value of 2.131 at p<0.05. In Group B the mean difference was 2.19, standard deviation was 0.91; the paired 'score was 9.6 which was greater than the table value of 2.131 at p<0.05. This shows there is a significant reduction in pain for NPRS in both groups. The result shows that pretest and posttest mean difference of NPRS for group A and group B have statistically significant difference.

TABLE: 2. MEAN, MEAN DIFFERENCE, STANDARD DEVIATION AND PAIRED „T" TEST VALUES OF MODI FOR GROUPS A & B

Groups	Means (%)	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A Pre-Test	36.75	23.88	5.63	16.96	p<0.05
Group A Post-Test	12.87				
Group B Pre-Test	40.50	12.61	7.8	6.7	p<0.05
Group B Post-Test	27.89				

Based on Table 2, the mean difference of group A was found to be 23.88, Standard deviation was 5.63; the 't' value using the paired 't' score was 16.96 which was greater than the table value of 2.131 at p<0.05. In Group B the mean difference was 7.8 standard deviation was 7.8; the 't' value using the paired score was 6.7 which was greater than the table value of 2.131 at p<0.05. This shows there is a significant reduction MODI in both groups. The result shows that pretest and posttest mean difference of MODI for group A and group B have statistically significant difference.

TABLE: 3. MEAN, MEAN DIFFERENCE, STANDARD DEVIATION AND PAIRED t TEST VALUES LUMBAR FLEXION FOR GROUPS A & B

Groups	Means (cms)	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A Pre-Test	4.38	-1.5	0.62	9.13	p<0.05
Group A Post-Test	5.88				
Group B Pre-Test	4	-1.4	1	5.74	p<0.05
Group B Post-Test	5.06				

Based on Table 3, the mean difference of group A was found to be -1.5, Standard deviation was 0.62 in; the 't' value using the paired 't' score was 9.13 which was greater than the table value of 2.131 at p<0.05. In Group B the mean difference was -1.4, standard deviation was 1; the 't' value using the paired score was 5.74 which was greater than the table value of 2.131 at p<0.05. This shows there is a significant improvement of lumbar flexion both groups. The result shows that pretest and posttest mean difference of lumbar flexion for group A and group B have statistically significant difference.

TABLE: 4. MEAN, MEAN DIFFERENCE, STANDARD DEVIATION AND PAIRED t TEST VALUES OF LUMBAR EXTENSION FOR GROUPS A & B

Groups	Means (cms)	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A Pre-Test	2.97	-1.28	0.77	6.7	p<0.05
Group A Post-Test	4.25				
Group B Pre-Test	2.63	-0.93	1	4.9	p<0.05
Group B Post-Test	3.56				

Based on Table 4, the mean difference of group A was found to be -2.97 Standard deviation was 0.77; the 't' value using the paired 't' score was 6.7 which was greater than the table value of 2.131 at p<0.05. In Group B the mean difference was -0.93, standard deviation was 1; the 't' value using the paired score was 6.7 which was greater than the table value of 2.131 at p<0.05. This shows there is a significant increase of lumbar extension both groups. The result shows that pretest and posttest mean difference of lumbar extension group A and group B have statistically significant difference.

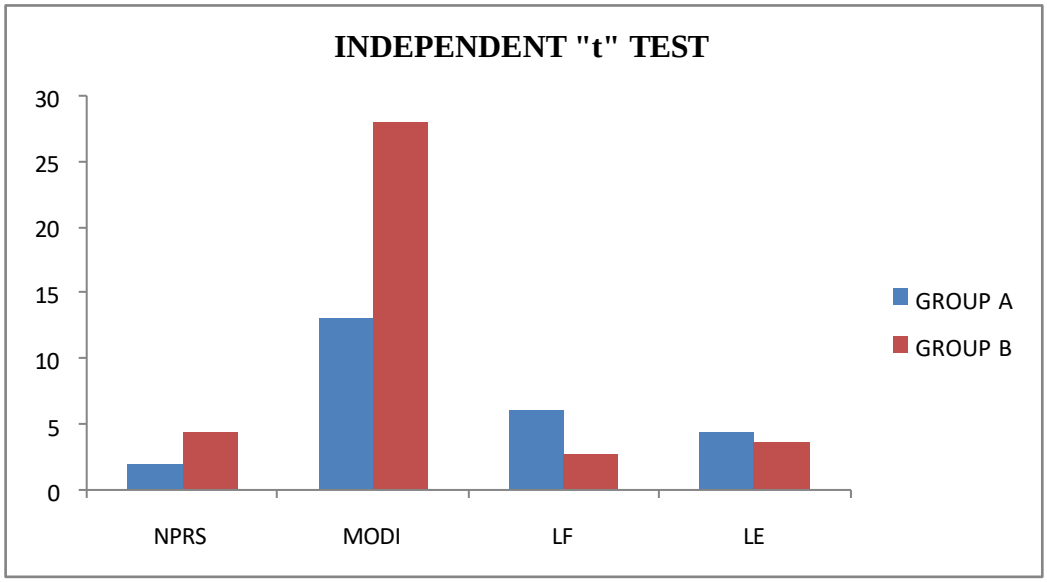
TABLE: 5. COMPARISON BETWEEN THE TEST VALUES OF GROUP A& B

Outcome Measures	Mean	Mean Difference	Standard Deviation	"t" value	"p" value
Numeric Pain Rating Scale	1.81	-2.38	Group A 0.75	7.38	p<0.05
	4.19		Group B 1.05		
Modified Oswestry Disability Index	12.88	-15	Group A 2.63	7.17	p<0.05
	27.88		Group B 7.95		

Lumbar Flexion	5.88 2.63	3.25	Group A 1.02 Group B 0.96	9.27	p<0.05
Lumbar Extension	4.25 3.56	0.69	Group A 0.68 Group B 0.81	2.59	p<0.05

Table 5 shows the independent 't' test was performed to analyze the significant difference between group A and group B for pain, functional disability, lumbar range of motion. Result shows there is significant difference between two groups for all outcome measures.

GRAPH 1:1



RESULT AND DISCUSSION

A total of 32 patients with mechanical low back pain of 20 - 50 years were recruited and grouped as two Movement Control Exercise (MCE) - Group A and Core Stability Exercise (CSE) - Group B by simple random sampling method. They were assessed for pain, lumbar flexion and extension ROM. After two weeks of intervention t for Numeric Pain Rating Scale (N RS), Modified Oswestry Disability Index (MODI), and Modified Schober Test (MMST) and between group differences. For pain, the paired 't' test value of group A and B is 16 and 9.6 respectively, which is greater than the table value indicating there is a significant difference within the groups.

The value of independent 't' test for both groups is 7.38 which is greater than the table value indicating there is a significant difference between the groups. Suraj Kumar et al (2015) [21], in their study they used NPRS grading to find out the pain level, had showed better pain reduction on using this scale. In relation to above study the same outcome measure has been used in my study to measure the pain intensity level of individuals.

Sumit B.Inani et al (2013) [16], in their study they used MODI for measuring the patient functional status and disability, had showed better reduction in functional disability ,in addressing the above study MODI used as a outcome measure in my study , which help me to assess the components of daily living and functional activities of individuals .

For Modified Oswestry Disability Index the calculated value of paired 't' test for group A (MCE) is 16.96 and for group B (CSE) is 6.7 which is greater than the table value

indicating there is a significant difference within the groups. The value of independent t test for both groups is 7.17 which is greater than the table value indicating there is significant difference between the groups.

On comparing within group analysis Group A scored 9.13 and Group B is 5.74 which is greater than the table value indicating that there is a significant difference within the groups. The value of independent t test for both groups is 9.27 which is greater than the table value

indicating there is significant difference between the groups. The data from group A (MCE) and B (CSE) for lumbar extension range were also analyzed using the calculated value of paired 't' test for group A (MCE) is 6.7 and for group B (CSE) is 4.9 which is greater than the table value indicating that there is a significant difference within the groups. The value of independent t test for both groups is 2.59 which is greater than the table value indicating there is significant difference between the groups.

William R et al (1993) [19] in his study he finds that MMST appears to be reliable method for measuring lumbar flexion and extension for patients with low back pain. In relation to above study MMST tool has been used in my study to measure the lumbar flexion and extension range of motion, it is accurate tool to measure the lumbar flexion and extension range of motion.

According to O'Sullivan P et al (2005) [2], up to one third of patients with low back pain are estimated to have movement control impairment. In relation to the above study, my study also addresses the patient with mechanical low back pain into classification of (flexion, extension, rotation, or combination of any two), this helps me to classify the patient dysfunction according to their movement control impairment. Patients with particular movement control impairment were also identified according to their impairment and treated with specific exercise to show a reduction in pain and disability and increase in range of motion. Two weeks of treatment duration is planned in my study [18].

Our findings suggest that Movement Control Exercise helps patients with mechanical low back pain to overcome their Pain, disability level which helped me to have better ADL (Activities of Daily Living) than compared to Group B.

Limitations Of The Study:

Control group was not planned.

Only two weeks treatment program was planned. Sample Planned was not met out due to time constraints.

Suggestions For Future Research:

In future studies long term follow up can be done to determine the effect of intervention.

The future studies can be added with other outcome measures to assess strength and other functional status in Mechanical Low back pain individuals.

In future studies blinding can be planned.

The study can be conducted with control group to rule out that the natural maturation of the syndrome which would influence the results.

The future study can be planned to all types of back pain with neurological involvement.

CONCLUSION

Based on Statistical Analyses this study shows that, there is a significant difference between core stability and movement control exercise in pain, range of motion and functional status in patients with mechanical Low back pain. So, we conclude that the movement control exercise is effective on reducing pain, improving range of motion and functional activities in patients with mechanical low back pain compared to core stability exercise.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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