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Original Article

Comparing the Effectiveness of Specific Lumbar Mobilization and Core Stability Exercises in Mechanical Low Back Pain in Decreasing Pain and Disability: A Randomized Control Trial

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ABSTRACT

Low back pain (LBP) is a global neuro - muscular problem developing significant disability of thoracic, lumbar or sacroiliac joint at any age. **Objective:** To analysis comparative effectiveness of specific lumbar mobilizations and core stability exercises in mechanical low back pain in reducing pain, ROM and disability. **Methods:** A patient blinded randomized trial was executed in the department of Physical therapy of Mayo Hospital, Lahore including 45 LBP patients randomly distributed into three groups. Each group received Conventional physical therapy in which Group A was control group, Group B received specific lumbar mobilizations while Group C received core stability exercises. NPRS, RMDQ and MODI were used for assessing pain and disability. SPSS version 24.0 was used for analyzing within and between group analysis through Paired T-test and Independent T- test with p-value <0.05. **Results:** The results showed conventional therapy, specific lumbar mobilization and core stability exercises are effective in improving pain, ROM and functional status. However; Core stability exercises was more effective with p-values for NPRS (p=0.049), MODI (p=0.038), RMDQ (p=0.003) and for Ranges (R-side flexion; 0.008, L-side flexion; 0.033, R-side rotation; 0.00, L-side rotation; 0.00) as compared to lumbar mobilization. Additionally; there was no substantial difference was found between three groups for flexion and extension. **Conclusions:** Core stability exercises are statistically and clinically more effective than conventional therapy and specific lumbar mobilizations in improving ROM, decreasing pain and functional status.

INTRODUCTION

Chronic low back pain (LBP), the most communal musculoskeletal condition with a pervasiveness of up to 84% in the grown-up population and world's chief cause of debility and a major welfare and economic issue and lasts for at least 12 weeks [1]. LBP affects human beings somewhere of their lives and its progression is too much and with time it becomes difficult to change [2]. LBP may be mechanical or non-mechanical in nature and causes more global disability than any other condition [3]. Degenerative disc diseases and spondylolysis with or without listhesis causes low back pain in athletes [4] while sacral hiatus (either highly placed apex or deficient posterior wall) is one of the major causes of mechanical low back pain in the Middle Ages [5]. Modic changes occur in persons with low backbone pain associated with disc degeneration and displacement and severity of disease. Weakness in gluteus medius and tenderness in glutei,

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greater trochanter and paraspinals is accompanying with lingering low back pain [6]. Incidence of acute sequel is due to infectious disease and short-term injuries and a small fraction of individuals experience no sequel to disease. The prevalence of chronic low back pain is common in health care professionals especially in France with 15-45% [7] and the in US; 13.1% point prevalent among 20–69 years old as 1 out of every 5 individual had LBP [8]. The continuing low backbone pain prevalence is 4.2 percent in individuals between 24-39 years old and 19.6 percent in those aged between 20-59 years and prevalence in old Brazilian population is 25.4 percent and in Brazilian population point prevalence is 37.1 percent, 76% prevalent in 1-year and 85.5% prevalent through life [9]. Male and female workers including nurses had high incidence of developing LBP due to their working hours. However; ethnicity reduced its prevalence as it is more common in White and Asian people while with lower incidence in Spanish people [10, 11]. Global prevalence of low backbone pain in adult general population has point prevalence of about 12%, with one month prevalence 23%, one year prevalence 38% and a lifetime prevalence of approximately 40% and prevalence increases with increasing age and maximum in the Russian Federation (56%) and deepest in China (22%) [12, 13]. Prevalence rates of low back pain increase with older age and affected by risk factors like genetic, gender and ethnicity, age, lack of exercise, heavy weight lifting, improper lifting, psychological factors and smoking [14]. There are a number of treatment preferences i.e., heat, massage, cold pack, mobilization and exercise therapy, and core stability exercises. Lumbar mobilization is the technique to mobilize spinal vertebral joints of lumbar region. The specific lumbar mobilization includes central antero-posterior-CPA, and unilateral antero-posterior-UPA glides applied on specific vertebras practice in prone lying position. These lumbar mobilizations are also active in chronic soreness and develop function in non-specific low backbone pain [15]. Core stability exercise are the re-establishment or of the capability of the neuromuscular machine to regulate and guard the spine from injury [16]. Core muscles include Local muscles cross one or two joints named multifidus, transversus abdominis (TrA), inter-transversarii and inter-spinalis, posterior fibers of psoas major [17] and global muscles cross several joints with pelvic and thorax attachments named rectus abdominis, external oblique and internal oblique, thoracic portion of longissimus and iliocostalis, quadratus lumborum lateral fibers, psoas anterior and latissimus dorsi lateral fibers [18]. Ahmad *et al.*, (2020) reported that combination of cores stability along with mobilization is an alternative therapy in reducing pain, improving RMDI scoring among chronic low back pain patients [19]. Additionally; Ibrahim *et al.*, (2023) reported that Maitland or specific mobilization is more beneficial in improving proprioceptive sensation along with VAS and ODI scoring functional level among chronic LBP patients [20].

The study was designed with an aim of determine the comparative effect of core stability exercises and specific lumbar mobilizations on pain and functional disability in subjects with power-driven low backbone pain.

METHODS

The single-blinded randomized control trial was performed after receiving Ethical permission from Ethical Review board of JIPS with the Reference number JIPS/ACD/23-141 on 10. March 2023. The study was conducted in the department of Physical Therapy of the Mayo hospital Lahore from March 2023 to August 2023 for 6 months. The sample size of 45 was calculated by using G power program by the research center of King Edward Medical University and recruited from the Outdoor male and female department of Hospital [21]. The inclusion criteria was the participants of both gender having 20-60 years of age was suffering from the mechanical low back pain were enrolled in the study [21]. Additionally; patients suffering from acute low back pain, history of any systemic disease, vertebral fracture, malignancy, and pregnancy are excluded from current study [22]. The patients were completely aware of the purpose of the study and each participants signed a proper written consent. Each participants were assessed according to the baseline assessment criteria. The baseline assessment involves the proper history taking procedure, physical examination of the lumbar spine (Inspection, palpation and movements) and the special tests including straight leg raising, slump test, passive lumber extension test, Quadrant test, Ober's test, rectus femoris test, 90-90 degree SLR and Thomas test [23]. After the assessment; Non-probability convenient sampling technique was used for the sample collection and through lottery method randomly allocation of patients were done into three groups received conservative physical therapy. Group A as a control group managed with conventional treatment protocol including hot pack, core strengthening (back isometrics, pelvic tilting and William flexion), whereas Group —B received combination of conservative and Specific Lumbar Mobilizations and Group — C received combination of conservative and Core Stability Exercises. Group A patients had to take the treatment session of 30 minutes in which hot pack was applied for 10 minutes. After this, William's flexion of 3 sets for 5 minutes, the patient performed back isometrics 3 sets for 10 minutes and pelvic bridging 3 sets for 5 minutes [24]. Group B was managed with Specific lumbar mobilization and conventional treatment. Firstly; hot pack was applied for 10 minutes in

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prone lying position. Additionally; the patient was lying in prone position in which a postero-anterior glides were applied by therapist from T12 to S1 using Maitland's technique in grade III. The whole session was completed with 3-4 sets of gliding for 10 minutes. After mobilization; patient performed William flexion, back isometrics and pelvic bridging with 3 sets for 5 minutes [25]. In Group C, patients were managed with conventional treatment with core stabilization. Firstly; hot pack was applied for 10 minutes in prone lying position. Additionally; the core stability exercises program includes static exercises were Plank, Side plank, Bridge and Super-man position. The dynamic exercises including Side lying with abduction, Oblique crunch, Straight leg raising (SLR) and Lying wind screen. These all activities were performed with 10 repetitions for 5-10 seconds [26]. The patients than performed William flexion, back isometrics and pelvic bridging with 3 sets for 5 minutes [24]. Outcome variables including pain, lumbar ranges and functional status was assessed through Numeric pain rating scale (NPRS), Modified Oswestry Disability Index (MODI) and Rolland and Morris disability questionnaire (RMDQ) and Goniometer. NPRS 11 point self-describing scale quantify intensity of pain from 0 (zero pain) - 10(severe pain). Having ICC =0.991 make it reliable tool for LBP pain assessment [27, 28]. MODI having 6 subdivision describing disability from 0 -5 [28] while RMDQ is self-reported 24 questionnaire, by replying YES or No assessing disability level among CLBP. MODI with 0.871 ICC value and having >3.5points of RMDQ are reliable and valid tool for evaluating functional status among LBP patients [29]. SPSS Statistical Power version 26.0 was used for statistical analysis. The analysis of demographic data were described through frequency (%). The within and across the group analysis of the pain, ranges and disability level were analyzed by using Paired sample t-test and One-Way ANOVA.

RESULTS

The results of the current study were described through tables. The baselines demographic variables of each group was defined in Table 1. Having no significant difference in demographic variables; the mean age of patients were 39.93±7.95, 37.53±9.48 and 40.87± 9.357 in Group A, B and C respectively. In the Table I; the gender distribution among groups was 3 (20%) male and 12 (80%) female, in groups B 6 (40%) male and 9 (60%) female and group C 6 (40%) male and 9 (60%) female. Furthermore; the socioeconomic status in group A were 6.7% upper class, 60% middle class and 33.3% lower class, in group B were 53.3% middle class and 46.7% belong to lower class and in group C 80% middle class and 20% belong to lower class. Table I described the behavior of pain as in group A was 13.3% had localized, 80% radiating and 6.7% have referred pain, in group B 20% had localized, and 80% radiating pain and in group C 26.7% had localized, and 73.3% had radiating pain. The occupation in-group A 13.3% had sedentary, 73.4% housewife and 13.3% had other job. However in Group B and C had 26.7% sedentary, 46.7% housewife, 13.3% laborers and 13.3% had other job and 40% sedentary, 46.7% housewife and 13.3% had other job respectively were described in Table 1.

Table 1: Demographic variables of patients

Variables		Results		
		Group A	Group B	Group C
		39.93±7.95	37.53±9.48	40.87± 9.357
Gender	Male	3 (20%)	6 (40%)	6 (40%)
	Female	12 (80%)	9 (60%)	9 (60%)
Socioeconomic Status	Upper Class	1 (6.7%)	0 (0%)	0 (0%)
	Middle Class	9 (60%)	8 (53.3%)	12 (80%)
	Lower Class	5 (33.3%)	7 (46.7%)	3 (20%)
Pain behavior	Localized	2 (13.3%)	3 (20%)	4 (26.7%)
	Radiating	12 (80%)	12 (80%)	11 (73.3%)
	Referred	(6.7%)	0 (0%)	0 (0%)
Occupation	Sedentary	2 (13.3%)	4 (26.7%)	6 (40%)
	Housewife	11 (73.4%)	7 (46.7%)	7(46.7%)
	Laborer	0 (0%)	2 (13.3%)	0 (0%)
	Other	2 (13.3%)	2 (13.3%)	2 (13.3%)

Table 2 reported significant reduction in pain intensity having post treatment NPRS scoring comparison in group A, B and C was 5.4 ±1.89, 5.15±1.5 and 3.93±1.65 respectively showing that core stability exercises are more effective in reducing pain in patients with power-driven low backbone pain with p-value = 0.049. Table 2 showed significant improvement in MODI and RMDQ post-treatment scoring among all groups but Post treatment comparison of mean MODI in group A, B and C was 24.20±5.59, 19.33 ±5.14 and 19.55±6.20 p- value= 0.038. Similarly; mean RMDQ in groups was 14.80±3.17, 13.27 ±3.82 and 10.53±2.56 with a p-value = 0.003 showing that core stability drills are more operative in reducing infirmity in patients of power-driven low back pain.

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Table 2: Pre and Post-treatment analysis of NPRS MODI and RMDQ of groups

Outcome Measure	Group A			Group B			Group C		
	Pre	Post	p	Pre	Post	p	Pre	Post	p
NPRS	6.63± 1.75	5.4 ±1.89	0.00*	6.9± 1.52	5.15±1.51	0.00*	6.53± 1.54	3.93±1.64	0.00*
MODI	25.4± 5.8	24.2±5.59	0.00*	21.26± 5.28	19.33±5.13	0.00*	23.33± 6.27	19.55 ±6.20	0.00*
RMDQ	16.7± 3.26	14.80±3.16	0.00*	16.13± 3.83	13.26±3.82	0.00*	14.67± 2.49	10.53±2.56	0.00*

Table 3 shows that Active rotation and side flexion improved in all groups as compared to the flexion and extension of lower back. On the comparison, mean flexion in group A, B and C was 37.33±7.67, 32.93±10.96 and 35.13±9.06 with p-value 0.441. The mean post-treatment extension was 18.4±6.55, 17.7±6.22 and 21.2±5.19 respectively with p-value 0.258. The result showed that both Core stability and Specific lumbar mobilization produced no significant difference in improving flexion and extension among on the low backbone pain. However, the post-treatment mean right side flexion in-group A, B and C was 12.33±3.08, 13.0±3.38 and 16.06±3.49 with a p-value 0.008. The mean left side flexion in groups was 12.06±3.84, 12.8±3.67 and 15.40±2.99 with a p-value 0.033. The mean right and left side rotation in group A was 11.67±3.56, while in group B and C was 10.28±3.10 and 15.867±2.50 respectively while 11.28±3.39, 9.80±2.42 and 15.733±2.34 with p-value 0.000. The results confirmed that p-value <0.05 indicating that core stability exercises are more effective in improving side flexions and rotation.

Table 3: Post-treatment Ranges of all groups

Ranges	Group A	Group B	Group C	p-value
Flexion	37.33±7.67	32.93±10.96	35.13±9.06	0.441
Extension	18.4±6.55	17.7±6.22	21.2±5.19	0.258
Right side flexion	12.33±3.08	13.0±3.38	16.06±3.49	0.008*
Left side flexion	12.06±3.84	12.8±3.67	15.40±2.99	0.033*
Right Rotation	11.67±3.56	10.28±3.10	15.867±2.50	0.000*
Left Rotation	11.28±3.39	9.80±2.42	15.733±2.34	0.000*

DISCUSSION

The study was designed with the purpose of determining the effectiveness of core stability and specific lumbar mobilization in the mechanical low back pain for decreasing pain and disability. The results of the study showed that core stability was statistically significant in managing pain, disability and ranges among low back pain patients with p-value < 0.05. However; among patients; there was no significant difference was observed in flexion and extension ranges among patients. Javaherain *et al.*, reported that Maitland PA mobilization is highly effective in improving pain and ranges especially rotation, lateral flexion and extension ranges of low back patients than flexion ranges [30]. The current study result showed significant improvement in extension range with 17.7±6.22. However; Qaseem *et al.*, reported that core stability exercises are highly significant in improving ranges flexion and extension of low back patients as it enhances the muscular strength of the deep core muscles. The muscles that were targeted in these exercises were local and global dynamic muscles [24]. The current study result showed the improvement in flexion and extension range with 35.13±9.06 and 21.2±5.19 respectively. However; on comparison; mobilization and core stabilization did not show any significant difference in improving flexion and extension ranges with p-value > 0.05. Islam *et al.*, reported that core stabilization is highly effective in reducing the pain intensity as core stabilization focus on managing the activation of global muscles with increasing the control of deep spinal muscle [31]. The current study showed significant reduction in pain intensity with p-value <0.05. Similarly; Ali *et al.*, reported that Maitland mobilization is effective in improving pain intensity among LBP patients especially grade I and II as it decrease the stimulation of nociceptors [21]. This supported current study results as pain reduction in Maitland group was significantly lower as compared to core stabilization due to the application of grade III. Similarly; Frizziero *et al.*, concluded that core stability exercises play an important role in enhancing spinal muscle thickness and activation. This activation helps in improving the pain and ranges that ultimately improve the functional status of patients and reduce disability [32]. This support current study results as MODI and RMDQ scores was significantly improved in core stability patients with p-value <0.05. Additionally; Outeda *et al.*, supported that Maitland mobilization played a significant role in improving pain and disability level in combination or alone application. However; this further depend on the grade of mobilization application [33]. This support current study result as MODI and RMDQ showed significant improvement while pain intensity did not show significantly improvement. Specific mobilization and core stabilization played significant improvement in pain and

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disability among mechanical low back pain. However; core stabilization is statistically significant in improving pain, disability and ranges of low back pain patients as compared to Specific lumbar mobilization. Limitations of this study were that this was a single centered study, as all the patients were taken from one hospital. The other limitations were shorter time duration, limited sample size was for this study was limited too. The main limitation was all patients met the inclusion criteria, but some patients were mainly inactive or drop out while others were principally standing or sitting during their waged hours and all these factors were ignored in this study. Primarily; a future research would be should be conducted with larger sample size for longer treatment session period for better understanding of effects. Other recommendations were evaluation of data by another blinded person, Formation of subgroups to further modify pain and follow up for extra one year to check sustainability of progress and to warrant devotion of patient to exercise.

CONCLUSIONS

The study concluded that core stability exercises are more effective than Specific Lumbar mobilizations and conventional treatment in reducing pain, improving range of motion especially right and left side flexion and right and left side rotation and functional status in LBP patients. However, lumbar mobilization and core stability exercises equally effective in flexion and extension.

Authors Contribution

Conceptualization: RH, AK
Methodology: SS
Formal analysis: SR, AZ
Writing-review and editing: MJ, LNK, AK

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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