

## RESEARCH ARTICLE

## EFFECTS OF ELDOA TECHNIQUE VERSUS MCKENZIE EXTENSION EXERCISES ON NON-SPECIFIC LOW BACK PAIN PATIENTS: A RANDOMIZED CLINICAL TRIAL

1. Lecturer, Institute of Health and Management Sciences, Islamabad, Pakistan
2. Assistant Professor, College of Applied Medical Sciences University of Hail, Hail, Kingdom of Saudi Arabia
3. Physiotherapist, Institute of Medical Rehabilitation, Islamabad, Pakistan
4. HOD/Assistant Professor, College of Rehabilitation Sciences, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad Pakistan

## Correspondence

Muniba Shamshad  
Institute of Health and Management Sciences,  
Islamabad, Pakistan Islamabad Pakistan  
E-mail: [munibashamshad780@gmail.com](mailto:munibashamshad780@gmail.com)

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**Muniba Shamshad<sup>1</sup>**: Conception, data collection, writing; revised and accountable for all aspects

**Raheela Kanwal<sup>2</sup>**: Analysis & interpretation of data, revised and accountable for all aspects

**Rizwana Butt<sup>3</sup>**: Interpretation of data, revised and accountable for all aspects

**Hafiz Muhammad Manan Haider<sup>4</sup>**: Analysis & revised and accountable for all aspects

## ABSTRACT

**Background:** Low back pain may lead cause disability in the patients. There are several physical therapy protocols used to manage the low back pain including McKenzie exercises. The Elongation Longitudinaux Avec Decoaption Osteo Artculaire (ELDOVA) is novel techniques could help to reduce the pain and disability related to lower back problems. **Objective:** to determine the effects and compare the McKenzie extension exercise and ELDOA stretch in non-specific low back pain patients. **Methodology:** A randomized clinical trial was conducted at Railway General Hospital, Rawalpindi and Irada Rehabilitation Center, Buchal Kalan from October 2021 - December 2021. The female participants with the age range of 40-69 years and had chronic non-specific low back pain for more than 3 months were included in the study. The participants were randomly divided into group A which received McKenzie extension exercises while group B received ELDOA stretch. The patient's outcome measures were assessed through Numeric Pain Rating Scale (NPRS), inclinometer for, flexi curve ruler for lordships angle, and Oswestry Disability Index (ODI) for disability. MANCOVA test was used for controlling the covariates at baseline. Friedman with post hoc Wilcoxon test (non-parametric-within group analysis) for ODI variables RMANOVA was applied to observe pairwise changes with-in the groups for ODI total score, lordosis angle at baseline, and end of second, and fourth week of the treatment. NPRS and range of motion (extension, flexion) at pre and post treatment session. **Results:** The mean age of study participant was 44.29±3.08. Within group analysis showed that significant improvement ( $p < 0.05$ ) was observed in both groups regarding ODI total score, NPRS, Lordosis angle and range of motion (flexion, extension) from baseline to the end of 4<sup>th</sup> week and at each level of assessment. The group A (McKenzie extension exercises) was a significantly improved on the combined dependent variables as compared to group B (ELDOA stretch) after controlling for baseline values of BMI, NPRS, lordosis angle and ROMs,  $F(7, 34) = 55.12, p < 0.001, Wilks' \Lambda = 0.018, \eta^2 = 0.49$ . **Conclusion:** McKenzie extension exercise showed better result in improving pain, range of motion, angle of lordosis and disability than ELDOA technique.

**Keywords:** disability, low back pain, physical therapy, stretching exercises. ROM

## INTRODUCTION

Low back pain is referred to an unpleasant feeling or discomfort in lumbar area that may or may not include buttocks<sup>1</sup>. The muscles which are involved in forward bending (40°-60°) of spine included iliopsoas major, minor and abdominal, while erector spinae and multifidus muscle group are involved in backward bending (20°-35°)<sup>2</sup>. Non-specific low back pain has unknown cause and it does not include any radicular symptoms<sup>3</sup>. 85% of population of low back pain have non-specific type of pain,<sup>4</sup> and is more common in older population but most frequently effect in age of 40-69 years. Females are more prone to low back pain than males<sup>5</sup>.

The factors which contribute to low back pain is poor biomechanics for longer duration encouraged loading on the spinal structures, improper sitting with the flexed spine. Due to prolong slouch posture, muscle imbalance occurs i.e. weak lumbar extensor, strong abdominals and tight hamstrings,

which disturb the normal inward curvature of lumbar region and leads to the straightening of curve thus moves the pelvis posteriorly. Therefore, lordosis further goes towards hypo lordosis<sup>6</sup>.

Different physical therapy interventions including thermotherapy, soft tissue release stimulation for muscles activation are used to treat the tighten structures<sup>7</sup>. Electric modalities such as interferential current (IFC) and transcutaneous electrical nerve stimulation (TENS) are used to treat chronic pain. IFC is more widely used than TENS because it is deeply impale and does not irritate skin<sup>8</sup>. Also, short wave diathermy is also used to treat chronic low back pain<sup>9</sup>. Furthermore, various exercise regimes includes for low back pain is William flexion,<sup>10</sup> strengthening exercises of core muscles,<sup>11</sup> and stabilization exercises<sup>12</sup>. ELDOA and McKenzie extension exercises are also used to treat low back pain.

ELDOA stands for Elongation Longitudinaux avec Decoaption Osteo-Artculaire. This technique is given in Europe by Gay Voyeur. ELDOA stretches

are used to correct the postural imbalance by improving the motion of muscle and fascia. Fascial stretching is carried out by adopting the special postures that target their respective vertebral segment. It reverse the narrowing of short structures by making pivot point to lower vertebra and move the upper vertebrae<sup>2</sup>. McKenzie extension exercises are effective in the treatment of chronic mechanical LBP<sup>13</sup>. Robin Anthony McKenzie gave the concept of extension exercises. The McKenzie method focuses on the centralization phenomenon for assessing and treating spinal pain, in which pain which originates from the spine refers distally, and with targeted repetiting movements, this pain will migrate toward the spine<sup>14</sup>.

In previous studies no comparison was done between McKenzie extension and ELDOA stretch. Also, ELDOA stretch was not used for hypo lordosis. Therefore in this study the effects of McKenzie extension exercise and ELDOA stretch in pain, range of motion, posture and disability was discussed, which wasn't discussed previously.

## METHODOLOGY

A single-blinded, randomized clinical trial (NCT05239247) was initiated after taking approval from Research Ethics Committee of Riphah University, Islamabad. The study was conducted at Railway General Hospital, Rawalpindi and Irada Rehabilitation Center, Buchal Kalan for a time

period of six month from March 2020 - September 2020.

The female participants were included with the age range of 40-69 years, who had chronic non-specific low back pain more than 3 months-pain of grade <3 measured on Numeric Pain Rating Sale, restricted ROM and lumbar straightening. However participants who had any other orthopaedic or neurological condition of hip and lumbar spine, sign and symptoms of lower motor neuron disease, using medication prescribed for pain, had radiculopathy, fracture, malignancy, lumbar trauma, and disc pathology were excluded from the study.

A total of n=55 participants were assessed for eligibility, out of which n=8 participants didn't fulfil the inclusion criteria and showed unwillingness to participate in the study. Thus, n=48 participants were recruited through non-probability purposive sampling technique. The randomization was done by the person who wasn't directly involved in the study. The flip a coin method was used for randomization and participants were divided into group A (n=24) which receive McKenzie extension exercises, and group B (n=24) received ELDOA exercises in addition to and conventional physical therapy. The patients were blinded to the allocated treatment while treating physiotherapist was unaware of the assessment and assessing physiotherapist was unaware of the treatment given.

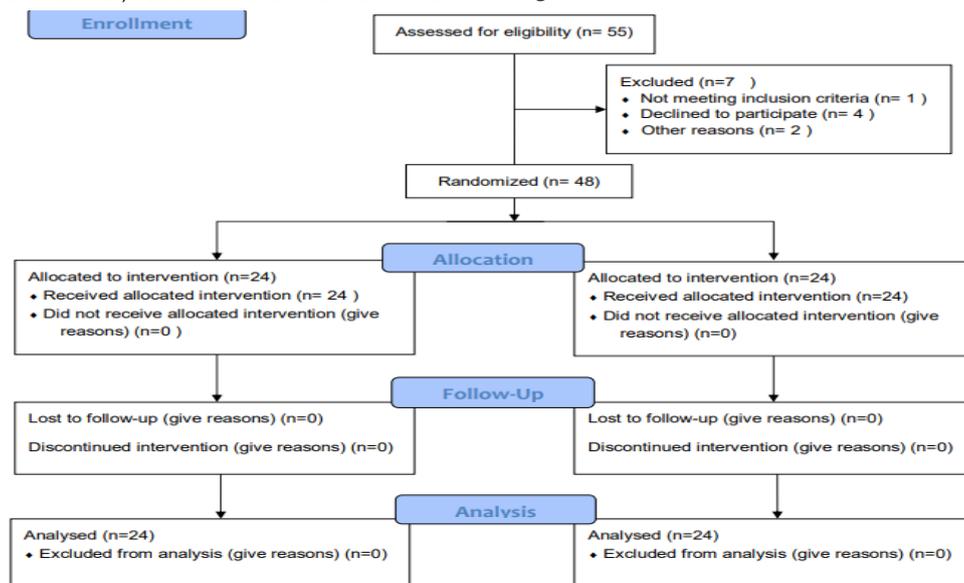


Figure 1: Consort Diagram

In group A (McKenzie extension), patient were asked to laid in prone position with both arms by the sides of the body and lifted the head and trunk off the plinth from neutral to extension. A total two sets of five repetitions with 45 seconds hold and 15 seconds rest between each set was performed in McKenzie extension.

Group-B received ELDOA stretch for L4- L5 levels. The patients were asked to sit down on a floor in upright position and keep your legs apart and knees semi-flexed, feet in outward and upward position, knees constantly pushing downwards, straight lower back, raise arms with palms facing upward, and chin should be pulled back. For L5-S1, patients were asked to lay on floor and flatten, bring your legs up and straight with the support of wall, straight knees and keep distance between them, connect your toes, raise arm and externally rotated with wrist extension now press your heels and palms out. ELDOA stretch was performed 2 sets of 5 repetitions with 45 second hold and 15 sec rest between each set once a day.

Conventional therapy was given in both groups, which included 10 minutes hot pack and 10 minutes Transcutaneous Electrical Nerve Stimulation (TENS) on lumbar region. Each session was given under the supervision of physiotherapist. The duration of intervention was 4 weeks, 3 sessions a week, a total of 12 sessions were given to the study participants. Each session lasted for 40 minutes.

The demographic data in terms of age, BMI, sitting and standing duration was obtained at baseline. The pain, ROM of lumbar extension and flexion, angle of lordosis and functional disability was

assessed at baseline, after 2<sup>nd</sup> week and 4<sup>th</sup> week. The NPRS scale was sued to determine the intensity of pain and is a valid and reliable tool<sup>15</sup>. The inclinometer was used to measure the ROM of lumbar flexion and extension. The inclinometer has constructed validity and reliability<sup>16</sup>. The flexi curve ruler was used to evaluate the spinal curve (angle of lordosis) to conclude the changes occurred in patient spinal angle and is a valid and reliable tool<sup>17</sup>. The functional disability was measured through total score of Oswestry Disability Index (ODI), which is a valid and reliable tool<sup>18</sup>. Prior to the data collection written informed consent was taken according to Deceleration of Helsinki.

As the baseline data of all outcome measure were not comparable, So the MANCOVA test was applied to compare the groups while controlling the baseline score of ODI, BMI, NPRS, Extension range of motion as a covariate. For with-in group analysis RM-ANOVA with Bonferroni correction for pairwise comparison was applied.

The data was presented as a frequency, mean, standard deviation, mean difference, degree of freedom, partial eta<sup>2</sup>, and p-value. The level of significance was at p<0.05. Data was statistically analysed using SPSS version 21.

## RESULTS

The mean age and BMI of study participant was 44.29±3.08 years and 23.80±4.40 kg/m<sup>2</sup> respectively. The mean of sitting was 5.85±1.01 hours and standing duration was 4.04±0.58 hours in the participants.

Table 1: With-in Groups Pairwise Changes.

		Group A				Group B			
		Mean	SD	MD/F(df)	p-value	Mean	SD	MD/F(df)	p-value
ODI	baseline	20.54 <sup>a</sup>	9.98	11.62	0.00***	18.41 <sup>a</sup>	9.20	9.197	0.00***
	after 2 <sup>nd</sup> week	8.91 <sup>b</sup>	7.25	8.91	0.00***	8.50 <sup>b</sup>	7.51	6.375	0.00***
	after 4 <sup>th</sup> week	.00 <sup>c</sup>	.00	91.05(1.137,26.15)	0.00***	2.12 <sup>c</sup>	2.75	114.56(1.38,31.74)	0.00***
Lordosis Angle	baseline	18.58 <sup>a</sup>	3.82	-8.54	0.00***	24.50 <sup>a</sup>	3.85	-3.95	0.00***
	after 2 <sup>nd</sup> week	27.12 <sup>b</sup>	4.04	-9.29	0.00***	28.45 <sup>b</sup>	3.75	6.37	0.00***
	after 4 <sup>th</sup> week	36.41 <sup>c</sup>	4.38	289.46(1.55,35.70)	0.00***	34.58 <sup>c</sup>	4.12	339.9(1.39,32.17)	0.00***
NPRS	baseline	6.91 <sup>a</sup>	1.28	4.41	0.00***	6.66 <sup>a</sup>	1.00	2.58	0.00***
	after 2 <sup>nd</sup> week	2.50 <sup>b</sup>	1.10	2.50	0.00***	4.08 <sup>b</sup>	.82	4.08	0.00***
	after 4 <sup>th</sup> week	.00 <sup>c</sup>	.00	443.18(1.89,43.46)	0.00***	.00 <sup>c</sup>	.00	733.74(1.72,39.75)	0.00***
Flexion	baseline	29.41 <sup>a</sup>	4.33	-6.00	0.00***	31.16 <sup>a</sup>	6.40	-15.66	0.00***
	after 2 <sup>nd</sup> week	35.41 <sup>b</sup>	3.80	-7.41	0.00***	46.83 <sup>b</sup>	5.08	-11.04	0.00***
	after 4 <sup>th</sup> week	42.83 <sup>c</sup>	2.79	448.35(1.49,34.40)	0.00***	57.87 <sup>c</sup>	2.62	474.48(1.72,39.55)	0.00***
Extension	baseline	10.79 <sup>a</sup>	5.32	-9.75	0.00***	9.00 <sup>a</sup>	4.29	-6.33	0.00***
	after 2 <sup>nd</sup> week	20.54 <sup>b</sup>	6.76	-11.37	0.00***	15.33 <sup>b</sup>	4.35	6.66	0.00***
	after 4 <sup>th</sup> week	31.91 <sup>c</sup>	4.31	506.6(1.54,35.54)	0.00***	22.00 <sup>c</sup>	3.93	532.85(1.37,31.50)	0.00***

<sup>a</sup>baseline to 2<sup>nd</sup> week, <sup>b</sup>2<sup>nd</sup> week to 4<sup>th</sup> week & <sup>c</sup>baseline to 4<sup>th</sup> week  
Significance Level: p<0.05\*, p<0.01\*\*, p<0.001\*\*\*

Within group analysis showed that significant improvement ( $p < 0.05$ ) was observed in both groups regarding ODI total score, NPRS, Lordosis angle and range of motion (flexion, extension) from baseline to the end of 4<sup>th</sup> week and at each level of assessment. (Table 1)

As the groups were not comparable at the baseline for all dependent variables, the MANCOVA test was applied. The results showed that there was a statistically significant difference between the intervention groups on the combined dependent variables after controlling for baseline values of BMI, NPRS, lordosis angle and ROMs,  $F(7, 34) = 55.12$ ,  $p < 0.001$ , Wilks'  $\Lambda = 0.018$ ,  $\eta^2 = 0.49$ .

Between the group univariate analysis after controlling the covariates, it was observed that

after 2<sup>nd</sup> week no significant difference between the groups ( $p \geq 0.05$ ), while after 4<sup>th</sup> week group A (McKenzie exercises) showed more improvement as compared to group B (ELDOA). The lordosis angle was also significantly improved after 2<sup>nd</sup> ( $p = 0.03$ ) and 4<sup>th</sup> ( $p = 0.005$ ) week in groups A as compared to group B. The group A showed that pain on numeric pain rating scale (NPRS) was significantly improved as compared to group B after 2<sup>nd</sup> week. But after 4<sup>th</sup> week pain level was zero in both groups ( $p = 1$ ). The ROMs (flexion and extension) was also improved in group A more significantly ( $p < 0.05$ ) than group B after 2<sup>nd</sup> and 4<sup>th</sup> week of intervention. (Table 2)

**Table 2: Univariate Comparison between the groups while controlling the Covariates**

		Group A (McKenzie)		Group B (ELDOA)		F(1,40)	p-value	partial $\eta^2$
		Mean	SD	Mean	SD			
ODI	Baseline	20.54	9.98	18.41	9.20	-	-	-
	After 2 <sup>nd</sup> week	8.91	7.25	8.50	7.51	.822	.370	.020
	After 4 <sup>th</sup> week	.00	.00	2.12	2.75	20.517	0.00***	.339
Lordosis angle	Baseline	18.58	3.82	24.50	3.85	-	-	-
	After 2 <sup>nd</sup> week	27.12	4.04	28.45	3.75	5.094	.030*	.113
	After 4 <sup>th</sup> week	36.41	4.38	34.58	4.12	8.878	.005**	.182
NPRS	Baseline	6.91	1.28	6.66	1.00	-	-	-
	After 2 <sup>nd</sup> week	2.50	1.10	4.08	.82	17.270	0.00***	.302
	After 4 <sup>th</sup> week	.00	.00	.00	.00		<b>1</b>	
Flexion	Baseline	29.41	4.33	31.16	6.40	-	-	-
	After 2 <sup>nd</sup> week	35.41	3.80	46.83	5.08	55.581	0.00***	.582
	After 4 <sup>th</sup> week	42.83	2.79	57.87	2.62	214.854	0.00***	.843
Extension	Baseline	10.79	5.32	9.00	4.29	-	-	-
	After 2 <sup>nd</sup> week	20.54	6.76	15.33	4.35	5.428	.025*	.119
	After 4 <sup>th</sup> week	31.91	4.31	22.00	3.93	31.278	0.00***	.439

Significance Level:  $p < 0.05$ \*,  $p < 0.01$ \*\*\*,  $p < 0.001$ \*\*\*.

## DISCUSSION

The purpose of study was to determine the effectiveness of McKenzie extension exercise and ELDOA stretch in improving pain, posture, range of motion and functional disability in non-specific low back pain patients. The results suggested that the study participants in both groups showed significant improvement throughout the treatment duration.

According to the results of the study, McKenzie extension exercises significantly improved non-specific low back pain and lumbar extension ROM. Similarly, a previous experimental study was conducted by Chopade P, revealed that McKenzie extension is an effective treatment to manage the non-specific low back pain and ROM<sup>19</sup>. Another study showed similar results conducted by Waqar S. et. in patients with chronic low back pain, that also reported significant improvement in pain,

mobility and quality of life by the McKenzie extension exercise protocol<sup>13</sup>. The factor of reduction in pain after McKenzie extension may be due to the correction and maintenance of posture that reduces stress and relax the muscles<sup>19-21</sup>, which also improves lumbar extension.

The results of the recent study also reported significant improvement in lumbar lordosis after extension exercises and literature also supported McKenzie extension exercises to improve lumbar lordosis. Improper posture leads to the mechanical deformation of soft tissues, which increased lumbar flexion. Thus McKenzie extension restore and maintain lumbar lordosis by relaxing the structures and thus correct the posture<sup>14</sup>. McKenzie extension exercises showed significant improvement in disability or functional limitation throughout the treatment duration which is in coherence with the previous study in which

statistically significant improvement was observed in disability or functional limitation measured through ODI<sup>22</sup>. The improvement might be attributed to decrease in pain, lumbar lordosis and increase in lumbar extension.

Furthermore, within group analysis showed significant improvement in pain, ROM, lordosis angle, functional disability. Previous literature also supported ELDOA techniques to improve, ROM, posture, and functional status<sup>23</sup>. The results of a recent study is in accordance with the previous literature in which significant improvement was observed in pain, and functional status<sup>24</sup>. The improvement occurred may be due to reduced stress<sup>22</sup> which be a reason of improved posture, ROM and function disability.

Between groups analysis showed lumbar extension was significantly improved in McKenzie extension exercises group while lumbar flexion was significantly improved in ELDOA exercises group. The reason of improving extension could be the mechanism of McKenzie extension i.e. during extension, the anterior structures of the spine are stretched, which are in stress due to the abnormal slouch sitting or standing with flexion, while the posterior structure that overworked and became more susceptible to injury are relaxed and helped in reducing pain<sup>19</sup>, and may improves lumbar extension. Also, continuous repetitions of McKenzie extension stretch the structures and according to then literature, relaxation after maximum stretch improves the range<sup>25</sup>. The reason of improving flexion range in ELDOA is may be due to hamstring stretching occurred during L4-L5 ELDOA pose. Hamstring tightness play a role in forward bending of spine and increase the risk of low back pain<sup>26</sup>. However, when hamstring tightness facilitates it will bring positive impact on lumbar range of flexion.

The limitations of the study included smaller sample size, which compromise the generalizability. Also, side bending and rotation of lumbar spine was not addressed.

## CONCLUSION

It is concluded that both techniques were effective in improving pain, range of motion, posture, and functional disability. But the McKenzie extension

was more effective as compared to the ELDOA technique.

Future studies should incorporated larger sample size. Follow up consultations should be administered to determine the long term effects should be done after completion of study. Determine the effectiveness of McKenzie extension and ELDOA stretch with specific low back pain patients. There was too little evidence available on ELDOA so more studies should be performed to find out its effectiveness. Future studies should be conducted on comparing the effects of ELDOA with other techniques of manual therapy.

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