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The Effect of McKenzie Assessment and Treatment Method on Patients with Chronic Low Back Pain with Radiculopathy, Single Blinded Randomized Controlled Trial

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Abstract

Purpose of the study: The aim of the study is to investigate the effect of McKenzie assessment and treatment method on patients with chronic low back pain with radiculopathy. **Methods**: Forty patients were randomly allocated in two equal groups (n=20), the control treatment only (Group B), while the other received the control treatment + MDT (Group A). Blindness is done by an independent assessor. All patients were assessed pre and post treatment using Oswestry Disability index (ODI) for disability, Pain DETECT questionnaire (PD-Q) for radiculopathy, Visual Analogue Scale (VAS) for pain intensity and inclinometer for trunk Range of Motion (ROM) Also, all patients were assessed using the McKenzie assessment sheet. The treatment method was 6-8 weeks, 2-3 sessions per week. **Results:** There was no significant difference in: PD-Q between group A and B post treatment ($p = 0.33$), VAS ($p = 1$), trunk ROM ($p = 0.07$). While There was a significant decrease in ODI of group A compared with that of group B post treatment ($p = 0.0001$). **Conclusion:** We found a significant improve in the disability in the favor of MDT over the control treatment while no difference between the two groups in the pain intensity, radiculopathy, and trunk ROM.

Key words: Chronic Low back Pain, McKenzie, MDT, disability, radiculopathy

1. Introduction:

Low Back Pain (LBP) is one of the most disabling disorders worldwide. It is one of the leading causes of doctors visit and sick leaves globally(1). According to various literature, chronic low back pain is the pain that persists more than 12 weeks (1)(2)(3)(4). Specific low back pain represents 15% of all types of low back pain, and 50% of specific low back pain is due to prolapsed inter vertebral disc pressing on the nerve roots causing radiculopathy (neuropathic pain along the course of the affected nerve(s)(5). Current guidelines prescribed the exercise therapy as a top evidence for chronic low back pain management(6)(7). McKenzie assessment and treatment method (MDT) is an evidence proved effective exercise for various spine pain management(8)(9). The McKenzie method for mechanical diagnosis and treatment (MDT) is a directional guided prescribed exercises and patient education for spinal pain management(9). The patient is initially assessed to be classified into one of three groups: derangement syndrome, dysfunctional syndrome and postural syndrome(10). MDT includes assessing the patient and according to the classification and direction preference (centralization phenomena), exercises are suited for each patient individually. Directional preference is a decrease of pain after a repetitive or sustained end range postures of the spine (11).

With many literature overviewed the effect of MDT on acute and sub acute low back pain(LBP), few studies with unclear results discussed the effect of McKenzie assessment and treatment method on the chronic low back pain and the effect of MDT on disability and radiculopathy in specific chronic low back pain.

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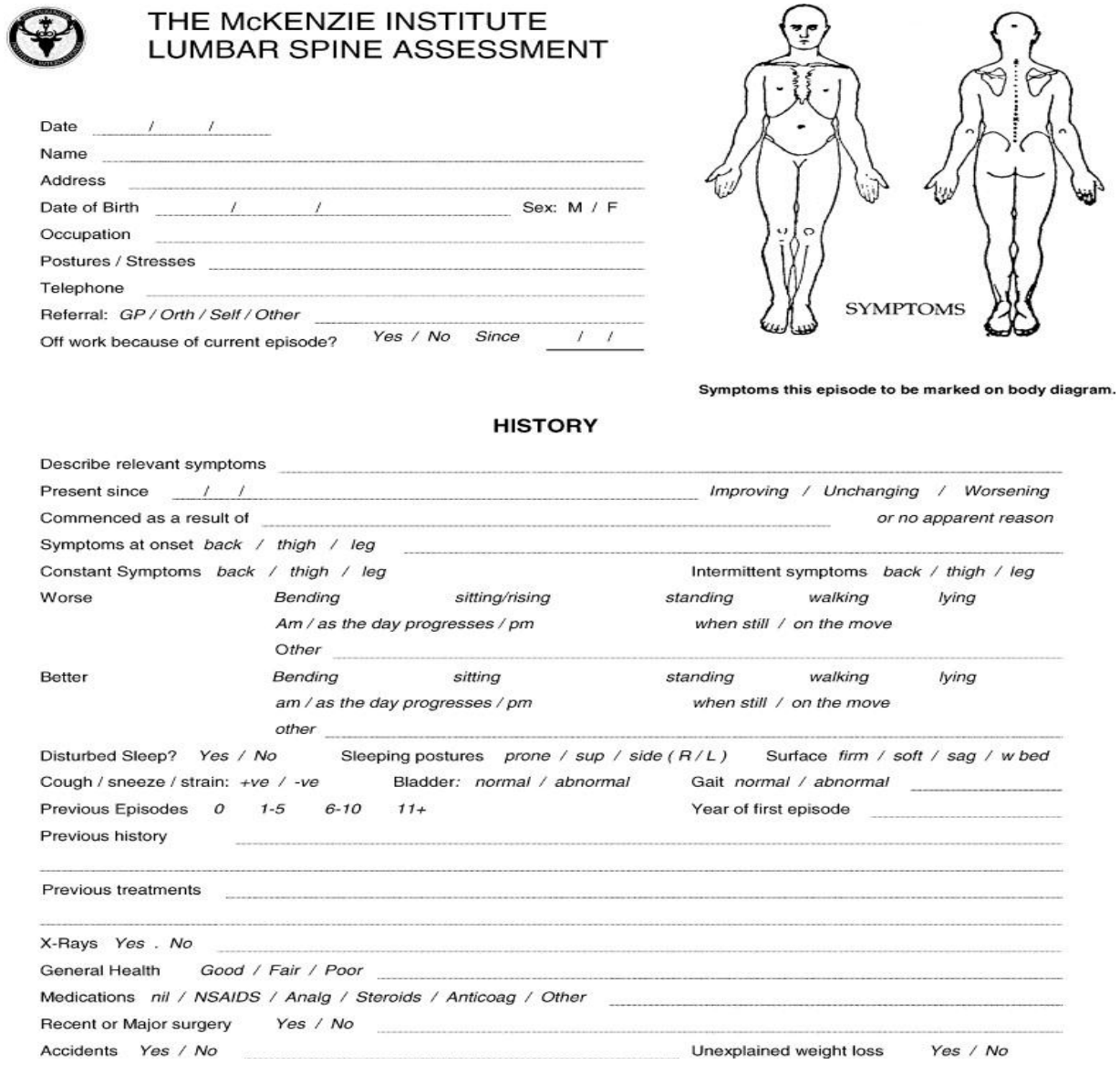
So the aim of the study is to investigate the effect of McKenzie assessment and treatment method (MDT) on pain, disability and radiculopathy in patients with chronic low back pain with radiculopathy.

2. Materials and Methodology:

2.1: Inclusion Criteria:

- Forty Patients with Chronic low back pain with radiculopathy due to lumbar disc prolapsed (more than 12 weeks).
- All patients have a direct preference and a centralization direction according to McKenzie assessment form **(Appendix 1)**
- Age of patients will range from 20-55 years old
- Both genders are equally recruited



THE McKENZIE INSTITUTE
LUMBAR SPINE ASSESSMENT

Date ___/___/___
Name _____
Address _____
Date of Birth ___/___/___ Sex: M / F
Occupation _____
Postures / Stresses _____
Telephone _____
Referral: *GP / Orth / Self / Other* _____
Off work because of current episode? *Yes / No* Since ___/___

SYMPTOMS

Symptoms this episode to be marked on body diagram.

HISTORY

Describe relevant symptoms _____
Present since ___/___/___ *Improving / Unchanging / Worsening*
Commenced as a result of _____ *or no apparent reason*
Symptoms at onset *back / thigh / leg* _____
Constant Symptoms *back / thigh / leg* Intermittent symptoms *back / thigh / leg*
Worse *Bending sitting/rising standing walking lying*
Am / as the day progresses / pm when still / on the move
Other _____
Better *Bending sitting standing walking lying*
am / as the day progresses / pm when still / on the move
other _____
Disturbed Sleep? *Yes / No* Sleeping postures *prone / sup / side (R / L)* Surface *firm / soft / sag / w bed*
Cough / sneeze / strain: *+ve / -ve* Bladder: *normal / abnormal* Gait *normal / abnormal* _____
Previous Episodes *0 1-5 6-10 11+* Year of first episode _____
Previous history _____
Previous treatments _____
X-Rays *Yes . No* _____
General Health *Good / Fair / Poor* _____
Medications *nil / NSAIDS / Analg / Steroids / Anticoag / Other* _____
Recent or Major surgery *Yes / No* _____
Accidents *Yes / No* Unexplained weight loss *Yes / No*

McKenzie Assessment sheet (Appendix 1)

2.2: Exclusion criteria:

- Spinal surgeries
- Another Causes of the radiculopathy

- pain that persists < 3 months
- spinal tumors
- Lumbar instability due to structural problem for example: ligament tear or spondylolythesis.
- Patients who do not have direction preference.
- Mental retardation or any mental problem that may interfere with the patient understanding the orders.

2.3: Randomization and blindness:

Randomization was done simply by coin toss.
The blindness was in the form of independent blinded assessor who assessed the patients before and after the interventions without knowing the patients groups.

2.4: Recruitment site:

Patients were recruited from the Faculty of Physical Therapy out clinic and AlQasr AlEiny Teaching Hospital.

2.5: Assessment:

Each patient was individually assessed by a blinded independent assessor by:

1- **Oswestry Disability Index (ODI) for assessment of disability.**
The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire) is an important scale used to measure a patient's functional disability.
2- **PainDETECT Questionnaire (PD-Q) for radiculopathy assessment**
It is a patient reported questionnaire to identify the patient neuropathic pain based on questions regarding typically the sensory symptoms of neuropathic pain.
3- **Visual Analogue Scale (VAS) for pain intensity assessment**
Each patient will rank his pain intensity from **0** which means no pain to **10** which means severe intensive pain.
4- **Spine inclinometer** for measuring the trunk ROM
The Arabic version for each scale was used as it was proved to be valid and reliable(12)(13)(14).
The trunk ROM measured were trunk flexion, extension and side bending to the right and to the left before and after the intervention. Also, all patients will be assessed using the McKenzie assessment form to determine the patients' direction preference and centralization effect **(Appendix 1).**

2.6: Intervention:

Forty patients were divided equally into two groups (n=20). Group A: the group which received the control treatment in addition to the McKenzie treatment method. Group B: the control treatment which received the control treatment only. The control treatment was the following:

1- TENS for 20 min
2- Heat by infrared lamps or hot packs
3- Lumbar stabilization exercises (LSE):
The (LSE) will be in the form of:
A. Curl up (raising the head and thorax) (3 sets from 5 to 10 rep. each)
B. Bridging exercise with leg left (2 sets with 10 rep. each)
C. Quadruped with arm and leg left (2 sets with 10 rep each)
All the exercises will be done while asking the patient to keep the spine in neutral.
4- Neural Glide for the sciatic nerve. (30 rept. For 1 – 2 sets)
5- Lumbar manipulation.

The rationale of the control treatment used in both groups was based on the latest guidelines used in management of the chronic low back pain.(15)(16)(17)(7). The McKenzie treatment was in the form of repetitive movements (flexion, extension, rotation) in the direction preference of the patients individually according to the assessment form.

Frequency: 3 sets with 10 rep. each

Also, the patients were educated how to do the exercises by themselves at home for 5 rep., 5 times per day.
The treatment duration for each group was from 6-8 weeks, 2-3 sessions per week.

3. Statistics:

Descriptive statistics and ANOVA-test were conducted for comparison of the mean age and MMSE of the two groups. Two-way mixed MANOVA test was conducted to compare the effect of time (pre versus post) and the effect of treatment (between groups), as well as the interaction between time and treatment on mean values of PD-Q, VAS, ODI and trunk ROM. The level of significance for all statistical tests was set at $p < 0.05$. All statistical tests were performed through the statistical package for social studies (SPSS) version 22 for windows. (IBM SPSS, Chicago, IL, USA).

4. Results:

Group A (McKenzie Group):

Twenty patients with chronic low back pain with radiculopathy were included in this group. The mean ± SD age and BMI were 39.85 ± 7.65 years and 27.98 ± 1.58 kg/m² respectively. (table 1).

Group B (The Control Group):

Twenty patients with chronic low back pain with radiculopathy were included in this group. The mean ± SD age and BMI were 40.3 ± 8.31 years and 28.16 ± 1.74 kg/m² respectively. (table 1). Comparing the general characteristics of the subjects of both groups revealed that there was no significance difference between the two groups in the mean age and BMI ($p > 0.05$).

Table 1. Descriptive statistics and ANOVA test for comparison of the mean age and BMI of the three groups (group A and B).

	Group A	Group B	F- value	p-value	Sig
	$\overline{X}$ ±SD	$\overline{X}$ ±SD			
Age (years)	39.85 ± 7.65	40.3 ± 8.31	0.26	0.76	**NS**
BMI (kg/m²)	27.98 ± 1.58	28.16 ± 1.74	0.06	0.94	**NS**

$\overline{X}$: Mean SD: Standard deviation p value: Probability value NS: Non significant

- Overall effect of treatment on PD-Q, VAS, ODI and trunk ROM:

Mixed MANOVA was conducted to investigate the effect of treatment on PD-Q, VAS, ODI and trunk ROM. There was a significant interaction effect of treatment and time ($p = 0.0001$). There was a significant main effect of treatment ($p = 0.0001$). There was a significant main effect time ($p = 0.0001$). (Table 2).

Table 2. *Mixed MANOVA for the effect of treatment on PD-Q, VAS, ODI and trunk ROM:*

Mixed MANOVA	
Interaction effect (treatment * time)	
$F_{(14,102)} = 7.51$	$p = 0.0001$
Effect of treatment (group effect)	
$F_{(14,102)} = 6.51$	$p = 0.0001$
Effect of time	
$F_{(7, 51)} = 289.89$	$p = 0.0001$

I- Effect of treatment on PD-Q:

Group A

The mean ± SD PD-Q pre treatment of group B was **35.85** ± **7.24** degrees, while post treatment was **20.25** ± 5.**64**. The mean difference was 15.6 and the percent of change was 43.**51**%. There was a significant decrease in PD-Q post treatment compared with that pre treatment in group A ($p = 0.0001$). (table 3).

Group B

The mean ± SD PD-Q pre treatment of group C was **35.5** ± 9.16, while post treatment was **23.05** ± **6.91**. The mean difference was **12.45** and the percent of change was 35.07%. There was a significant decrease in PD-Q post treatment compared with that pre treatment in group B ($p = 0.0001$). (Table 3).

Comparison between groups

There was no significant difference between the two groups pre treatment ($p > 0.05$), There was no significant difference in PD-Q between group A and B post treatment ($p = 0.33$). (Table 3).

Table 3. ***Effect of treatment on PD-Q***

PD-Q						
		Group A		**Group B**		
		$\overline{X}$ **± SD**		$\overline{X}$ **± SD**		
		Pre	**Post**	**Pre**	**Post**	
		35.85 ±7.24	**20.25 ± 5.64**	**35.5** ± 9.16	**23.05 ± 6.91**	
Within group comparison (time effect)						
			MD	**% of change**	**p-value**	**Sig**
Pre vs post						
	Group A		15.6	43.51	0.0001	**S**
	Group B		12.45	35.07	0.0001	**S**
Between group comparison (group effect)						
			MD	**p- value**		**Sig**
Pre Vs. Post	**Group A vs B**		0.35	1		**NS**
	Group A vs B		-2.8	0.33		**NS**

II- Effect of treatment on VAS:

Group A

The mean ± SD VAS pre treatment of group B was 7.6 ± 1.04 degrees, while post treatment was 3.15 ± 1.92. The mean difference was 4.45 and the percent of change was 58.55%. There was a significant decrease in VAS post treatment compared with that pre treatment in group A ($p = 0.0001$). (table 4).

Group B

The mean ± SD VAS pre treatment of group C was 7.8 ± 1, while post treatment was 3.4 ± 1.6. The mean difference was 4.4 and the percent of change was 56.41%. There was a significant decrease in VAS post treatment compared with that pre treatment in group B ($p = 0.0001$). (table 4).

Comparison between groups

There was no significant difference between the two groups pre treatment ($p > 0.05$), There was no significant difference in VAS between group A and B post treatment ($p = 1$). (table 4).

VAS						
		Group A		**Group B**		
		$\overline{X}$ **± SD**		$\overline{X}$ **± SD**		
		Pre	**Post**	**Pre**	**Post**	
		7.6 ± 1.04	3.15 ± 1.92	7.8 ± 1	3.4 ± 1.6	
Within group comparison (time effect)						
			MD	**% of change**	**p-value**	**Sig**
Pre vs post						
	Group A		4.45	58.55	0.0001	**S**
	Group B		4.4	56.41	0.0001	**S**
Between group comparison (group effect)						
			MD	**p- value**		**Sig**
Pre Vs. Post	**Group A vs B**		-0.2	1		**NS**
	Group A vs B		-0.25	1		**NS**

Table 4. ***Effect of treatment on VAS.***

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

III- Effect of treatment on ODI:

Group A

The mean ± SD ODI pre treatment of group B was 69.32 ± 11.45%, while post treatment was 28.62 ± 9.26%. The mean difference was 40.7% and the percent of change was 58.71%. There was a significant decrease in ODI post treatment compared with that pre treatment in group A (p = 0.0001). (table 5).

Group B

The mean ± SD ODI pre treatment of group C was 71.82 ± 16.44%, while post treatment was 48.59 ± 8.79%. The mean difference was 23.23% and the percent of change was 32.34%. There was a significant decrease in ODI post treatment compared with that pre treatment in group B (p = 0.0001). (table 5).

Comparison between groups

There was no significant difference between the two groups pre treatment (p > 0.05), There was a significant decrease in ODI of group A compared with that of group B post treatment (p = 0.0001). (table 5).

ODI (%)					
	Group A		**Group B**		
	$\overline{X}$ **± SD**		$\overline{X}$ **± SD**		
	Pre	**Post**	**Pre**	**Post**	
	69.32 ±11.45	28.62 ± 9.26	71.82 ± 16.44	48.59 ± 8.79	
Within group comparison (time effect)					
		MD	**% of change**	**p-value**	**Sig**
Pre vs post					
	Group A	40.7	58.71	0.0001	**S**
	Group B	23.23	32.34	0.0001	**S**
Between group comparison (group effect)					
		MD	**p- value**		**Sig**
Pre	**Group A vs B**	-2.5	1		**NS**
Post	**Group A vs B**	-19.97	0.0001		**S**

Table 5. ***Effect of treatment on ODI.***

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

IV- Effect of treatment on trunk flexion ROM:

Group A

The mean ± SD trunk flexion ROM pre treatment of group B was 60.65 ± 8.38 degrees, while post treatment was 72.1 ± 5.48 degrees. The mean difference was -11.45 degrees and the percent of change was 18.87%. There was a significant increase in trunk flexion ROM post treatment compared with that pre treatment in group A (p = 0.0001). (table 6).

Group B

The mean ± SD trunk flexion ROM pre treatment of group C was 59.8 ± 6.79 degrees, while post treatment was 66.8 ± 10.27 degrees. The mean difference was -7 degrees and the percent of change was 11.7%. There was a significant increase in trunk flexion ROM post treatment compared with that pre treatment in group B (p = 0.0001). (table 6).

Comparison between groups

There was no significant difference between the two groups pre treatment (p > 0.05), There was no significant between group A and B post treatment (p = 0.07). (table 6).

Trunk flexion ROM (degrees)						
		Group A		Group B		
		$\overline{X}$ ± SD		$\overline{X}$ ± SD		
		Pre	Post	Pre	Post	
		60.65 ± 8.38	72.1 ± 5.48	59.8 ± 6.79	66.8 ± 10.27	
Within group comparison (time effect)						
		MD	**% of change**	**p-value**	**Sig**	
Pre vs post						
	Group A	-11.45	18.87	0.0001	**S**	
	Group B	-7	11.7	0.0001	**S**	
Between group comparison (group effect)						
		MD	**p- value**		**Sig**	
Pre	**Group A vs B**	0.85	1		**NS**	
Post	**Group A vs B**	5.3	0.07		**NS**	

Table 6. ***Effect of treatment on trunk flexion ROM.***

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

V- Effect of treatment on trunk extension ROM:

Group A

The mean ± SD trunk extension ROM pre treatment of group B was 8.75 ± 2.88 degrees, while post treatment was 15.5 ± 1.76 degrees. The mean difference was -6.75 degrees and the percent of change was 77.14%. There was a significant increase in trunk extension ROM post treatment compared with that pre treatment in group A (p = 0.0001). (table 7).

Group B

The mean ± SD trunk extension ROM pre treatment of group C was 8.1 ± 3.19 degrees, while post treatment was 14.45 ± 3.28 degrees. The mean difference was -6.35 degrees and the percent of change was 78.39%. There was a significant increase in trunk extension ROM post treatment compared with that pre treatment in group B (p = 0.0001). (table 7).

Comparison between groups

There was no significant difference between the two groups pre treatment (p > 0.05), Also there was no significant difference in trunk extension between the two groups post treatment (p > 0.05). (table 7).

Trunk extension ROM (degrees)						
		Group A		Group B		
		$\overline{X}$ ± SD		$\overline{X}$ ± SD		
		Pre	Post	Pre	Post	
		8.75 ± 2.88	15.5 ± 1.76	8.1 ± 3.19	14.45 ± 3.28	
Within group comparison (time effect)						
		MD	**% of change**	**p-value**	**Sig**	
Pre vs post						
	Group A	-6.75	77.14	0.0001	**S**	
	Group B	-6.35	78.39	0.0001	**S**	
Between group comparison (group effect)						
		MD	**p- value**		**Sig**	
Pre	**Group A vs B**	0.65	1		**NS**	
Post	**Group A vs B**	1.05	0.56		**NS**	

Table 7. ***Effect of treatment on trunk extension ROM.***

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

VI- Effect of treatment on trunk right bending ROM:

Group A

The mean ± SD trunk right bending ROM pre treatment of group B was 12.95 ± 3 degrees, while post treatment was 15.95 ± 1.84 degrees. The mean difference was -3 degrees and the percent of change was 23.16%. There was a significant increase in trunk right bending ROM post treatment compared with that pre treatment in group A (p = 0.0001). (table 8).

Group B

The mean ± SD trunk right bending ROM pre treatment of group C was 14.15 ± 3.29 degrees, while post treatment was 16.05 ± 2.08 degrees. The mean difference was -1.9 degrees and the percent of change was 13.42%. There was a significant increase in trunk right bending ROM post treatment compared with that pre treatment in group B (p = 0.0001). (table8).

Comparison between groups

There was no significant difference between the two groups pre treatment (p > 0.05), Also there was no significant difference in trunk right bending between the two groups post treatment (p > 0.05). (table 8).

Trunk right bending ROM (degrees)					
	Group A		**Group B**		
	$\overline{X}$ **± SD**		$\overline{X}$ **± SD**		
	Pre	**Post**	**Pre**	**Post**	
	12.95 ± 3	15.95 ± 1.84	14.15 ± 3.29	16.05 ± 2.08	
Within group comparison (time effect)					
		MD	**% of change**	**p-value**	**Sig**
Pre vs post					
	Group A	-3	23.16	0.0001	**S**
	Group B	-1.9	13.42	0.0001	**S**
Between group comparison (group effect)					
		MD	**p- value**		**Sig**
Pre	**Group A vs B**	-1.2	0.84		**NS**
Post	**Group A vs B**	-0.1	1		**NS**

Table 8. ***Effect of treatment on trunk right bending ROM.***

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

VII- Effect of treatment on trunk left bending ROM:

Group A

The mean ± SD trunk left bending ROM pre treatment of group B was 13.25 ± 2.67 degrees, while post treatment was 16.5 ± 1.67 degrees. The mean difference was -3.25 degrees and the percent of change was 24.52%. There was a significant increase in trunk left bending ROM post treatment compared with that pre treatment in group A (p = 0.0001). (table 9).

Group B

The mean ± SD trunk left bending ROM pre treatment of group C was 14 ± 3.09 degrees, while post treatment was 16.45 ± 2.03 degrees. The mean difference was -2.45 degrees and the percent of change was 17.5%. There was a significant increase in trunk left bending ROM post treatment compared with that pre treatment in group B (p = 0.0001). (table 9).

Comparison between groups

There was no significant difference between the two groups pre treatment (p > 0.05), Also there was no significant difference in trunk left bending between the two groups post treatment (p > 0.05) (table 9).

Trunk left bending ROM (degrees)						
		Group A		Group B		
		$\overline{X}$ ± SD		$\overline{X}$ ± SD		
		Pre	Post	Pre	Post	
		13.25 ±2.67	16.5 ± 1.67	14 ± 3.09	16.45 ± 2.03	
Within group comparison (time effect)						
			MD	**% of change**	**p-value**	**Sig**
Pre vs post						
	Group A		-3.25	24.52	0.0001	**S**
	Group B		-2.45	17.5	0.0001	**S**
Between group comparison (group effect)						
			MD	**p- value**		**Sig**
Pre	**Group A vs B**		-0.75	1		**NS**
Post	**Group A vs B**		0.05	1		**NS**

Table 9. Effect of treatment on trunk left bending ROM.

$\overline{X}$: Mean **SD: Standard Deviation** **MD: Mean difference**
p value: Probability value **S: Significant** **NS: Non significant**

5. Discussion:

5.1: Interpretation of the findings:

Chronic low back pain is not only causing pain locally in the back but also affects different aspects of the patient's life including independence, relationships, self esteem and orientation, mobility, sexual function, sleep and mobility(4). With various studies recommend non pharmacological management of chronic low back pain, exercises and self orientation and patient education become on the top of the hierarchy of evidence(18)(19)(20)(21). We observed an intergroup improvement within each group before and after treatment in all aspects of disability, radiculopathy and pain intensity. We recommend that the improvement of ROM within each group is as a result of decrease of pain as well as decrease of the pain avoidance behavior. Also, we recommend that the improvement of disability measured by the ODI in the favor of the MDT group is a result of the patient education and self management of the patient at home. In spite of insignificant difference between the two groups in the pain intensity and radiculopathy and ROM, both groups significantly improved after the treatment. We recommend that the improvement in pain intensity and radiculopathy was a result of combining both muscular facilitation in the Lumbar stabilization exercises which in return causes an exercise induced hypoalgesia effect(22), neural glide (23)and manipulation (7,18,21,24)in both groups.

5.2 limitations:

During the study we faced some limitations includes:

1-We could not record the patient adherence to home exercises by reliable method rather than orally asking the patients if they do the exercises or not.

2-Three patients did not accept the spinal manipulation from the first session due to misconception of the effect of the spine manipulation to be harmful, but they started to accept adding manipulation from the third or fifth session.

We do not know if this delay affected their results or not.

3-One patient had a sensitive skin and refused to add heat to his program.

6. Conclusion:

McKenzie assessment and treatment method is an effective tool in managing chronic low back pain with radiculopathy patients in improving disability but as the same as the control treatment in the aspects of pain intensity, radiculopathy and trunk range of motion.

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