Original Article

# Mulligan mobilization vs. spinal manipulation effect on low back pain

**Mohamed Nabil Fiaad[1]*, Wadida H. Elsayed[2], Mary Kamal Nassif Takla[2], Aly M. El Zawahry[3]**

[1]Department of Basic Science for Physical Therapy, Faculty of Physical Therapy, Modern University for Technology and Information University, Cairo, Egypt. [2]Department of Basic Science for Physical Therapy, Faculty of Physical Therapy, Cairo University, Egypt. [3]Orthopedic Surgery Department, Faculty of Medicine, Cairo University, Egypt.

**Correspondence:** Mohamed Nabil Fiaad, Department of Basic Science for Physical Therapy, Faculty of Physical Therapy, Modern University for Technology and Information University, Cairo, Egypt. **Email:** dr.m_nabil @ yahoo.com

## ABSTRACT

Background: Non-specific low back pain (NSLBP) is characterized by reduced mobility associated with pain during the functional activity of unknown etiology. Objective: To compare the effects of spinal manipulation (SM) and Mulligan-mobilization with movement (MWM) in NSLBP. Method: Forty-five participants with chronic NSLBP were randomly allocated into three equal groups (fifteen patients each); group A (control group) received conventional physical therapy program including superficial heating and spinal stabilization exercises (SSE). Group B received the SSE and SM techniques. Group C received SSE and MWM technique. The treatment was applied for 3 sessions per week for 4 consecutive weeks. Outcome measures: Pain intensity level, Functional impairment, and Lumbar flexion ROM were measured by Visual Analogue Scale (VAS), Oswestry disability scale, and Inclinometer respectively. The measurements were taken pre-treatment and post-treatment. Results: There were statistical differences between the 3 groups, where group B showed a greater improvement in pain intensity level, functional impairment, and spinal mobility than the other two groups. Conclusion: Manual therapy techniques, as well as SSE, were effective in increasing lumbar flexion ROM, decreasing pain intensity level, and improving function. Nonetheless, SM with SSE was shown to be superior over the MWM and SSE in terms of reducing pain intensity level, increasing ROM, and improving function in NSLBP.

**Keywords:** Low back pain, mobilization with movement technique, spinal manipulation, Oswestry disability scale.

## Introduction

In relation to human suffering, non-specific low back pain (NSLBP) is the most prevalent complaint among working-age people; it creates a financial strain owing to the use of medical facilities and the lack of job [1].

Non-specific low back pain includes changes in the position of the spinal joint, movement features, and/or related palpable paraspinal soft tissue alternations with symptoms that vary with physical activity; includes any abnormality in the back function, describing back pain from innervated structures [2].

Spine manipulation (SM) is a method of manual therapy conducted to improve ROM in a joint with decreased joint play, with the aim of relieving pain in patients. SM includes a short-amplitude high-speed "impulse" or "thrust" applied to facet joints. In a recent systematic review, the efficacy of SM in dealing with musculoskeletal pain was summarized [3].

Overall, evidence indicates that SM provides greater pain relief and function improvement than a placebo or no therapy. Although SM is widely used in pain management, it continues unknown in the physiological foundation of its efficacy. It was suggested that the mechanical stimuli produced by SM should activate the release of many biochemical mediators from neural tissues [4-6].

Mulligan has developed a comparatively fresh idea in manual therapy with implementation in the management of LBD. The idea included a sustained mobilization along the facet treatment plane while the patient performs the painful physiological motion actively. The technique is known as mobilization with movement (MWM) or SNAG, an acronym

| Access this article online | |
|---|---|
| **Website:** www.japer.in | **E-ISSN:** 2249-3379 |

**How to cite this article:** Mohamed Nabil Fiaad, Wadida H. Elsayed, Mary Kamal Nassif Takla, Aly M. El Zawahry. Effect of mulligan mobilization versus spinal manipulation on management of non-specific low back pain. J Adv Pharm Educ Res. 2020;10(1):70-5.
Source of Support: Nil, Conflict of Interest: None declared.

for 'sustained natural apophyseal glide' which can be applied to all spinal joints, the rib cage, and the sacroiliac joint. The difference between MWM and other types of mobilization lies with the combination of passive accessory movement mobilization done by the therapist with the patient's active movement. The manual mobilization was aimed to correct the faulty position of bones [7, 8].

Because of the proven impact of both Spinal Manipulation and Mulligan mobilization in the musculoskeletal system dysfunction, this research was performed to compare the impacts of spinal manipulation (SM) and Mulligan-mobilization with movement (MWM) in NSLBP.

## Materials and Methods

### Trial design and Participants

A single-blinded randomized controlled trial design was conducted, at the School of Physical Therapy, Cairo University, Giza, Egypt, from May 2017 until July 2018. We recruited 45 participants, 24 males and 21 females, with the ages ranging from 25 to 45 years, from the outpatient clinic of the School of Physical Therapy at Cairo University. Participants with NSLBP were randomized in blocks and assigned to three equal groups (fifteen patients per group); group A (control group) received conventional physical therapy program including Superficial heating and spinal stabilization exercises (SSE), (Group B) received SSE and SM technique. (Group C) received SSE and MWM technique. Treatment was applied for 3 sessions per week for 4 consecutive weeks. All participants provided written informed consent to participate in our study. The age and BMI of the patients were written and put a closed envelope containing the patient's name and were randomly selected for each group.

### Exclusion and inclusion criteria

Inclusion criteria: (1) must have experienced LBP consistently over the preceding 3 months before the investigation; (2) Oswestry disability score (ODI) of at least 25%; (3) stiffness in the lumbar spine ; (4) The cause of the back pain was chronic NSLBP that was diagnosed by an orthopedic physician. Exclusion criteria: (1) any kind of back or leg condition as hip arthrosis, previous lumbar surgery, lumbar radiculopathy or myelopathy, (2) undertaken physical therapy interventions for the lumbar spine in the last 3 weeks.

### Assessment procedure

Pain Intensity Level Measurement by using the VAS, which uses a line of 10 cm, divided from 0 to 10, 0 refers to no pain and 10 refers to the worst pain. The patients were asked to mark along the line at the point, which refers to their level of pain.

Functional Disability was measured by the Oswestry disability questionnaire, consisted of 10 multiple choice questions for back pain, which the patient selected one of the 6 sentences that best described his/her pain intensity level, higher scores indicated great pain [9].

Lumbar spine flexion ROM assessed by using an inclinometer, which consists of a circular, fluid-filled disk with a bubble that indicates the number of degrees on the scale of protractor [10].

### Interventions

### Spinal Manipulation

The therapist selected the spinal level towards which to direct the SM based on the assessment of segmental mobility in a prone position. The most painful side was manipulated first followed by the other sides, based on the participant's self-report. The therapist selected either side when the participant could not specify the most painful side.

With the participant side-lying with the more painful side up and the therapist standing in front of him, the therapist flexed the uppermost leg at the knee and hip until there was a movement at the selected segment (eg. L4–L5) interspace. The participant's uppermost foot was then placed in the popliteal fossa of the lowermost leg. Next, the therapist grasped the participant's lowermost arm pulling it towards him, creating left trunk side bending and right rotation until feeling the motion at the L4–L5 interspace. The right index of the therapist was then placed on the right side of the L4 spinous process and the left index on the right side of L5 spinous process. The participant's arms were then positioned around the therapist's right arm. This setup position was sustained while the participant was turned toward the therapist. Finally, the left arm of the therapist was used to apply an HVLAT at the pelvis in the anterior direction.

### Mulligan's mobilization with movement

The therapist stood behind the participant with ulnar border on the relevant spinous process centrally, in the manner described by Mulligan. SNAGs were then applied in a direction parallel to the lumbar facet joints while the participant performed an active lumbar flexion. At the end of the flexion range, each SNAG was sustained for a few seconds. Four sets of 10 repetitions were performed after a pilot experiment for the participant's familiarization and ensuring the desired comfort. A belt was used to allow a full active pain-free flexion and stabilize the pelvic girdle [7, 8].

### Standardized exercise program

All of the participants performed a daily strengthening and stabilization exercise program for 4 weeks. The exercises were done 3 times/week, comprising a sequence of 6-10 repetitions, for 1-3 sets. While on the remaining 4 days, where they did not receive the exercise program during the physical therapy session, the participants were directed to do the exercises at home. The exercise program targeted the trunk musculature that has been identified as crucial stabilizers of the spine including transversus abdominus, oblique abdominals, multifidus/erector spinae, diaphragm, and pelvic floor [11].

## Statistical analysis

Descriptive statistics data including the standard deviation and mean were used for demographic data (age, weight, height, and BMI), ROM (Flexion), pain intensity level, and Oswestry score variables.

3×2 mixed design Multivariate analysis of variance (MANOVA) was used to compare the tested variables of interest at different tested groups and measuring periods.

Bonferroni correction test was used to compare the pairs of groups for post-treatment of the tested variables, in which F was significant from the MANOVA test.

All statistical analyses were significant at the 0.05 level of probability ($P \leq 0.05$).

## Results

1. Demographic data: The statistical analysis by (MANOVA - test) revealed no significant differences ($P>0.05$) in demographic data (age, weight, height, and BMI) among the groups A, B, and C (Table 1).

**Table 1: Comparison of the mean values of demographic data among groups A, B, and C.**

| | Group A (Conventional) (n=15) | Group B (SM) (n=15) | Group C (MWM) (n=15) | F-value | P value | |
|---|---|---|---|---|---|---|
| **Age (Year)** | 31.47 ±4.53 | 31.60 ±4.92 | 32.47 ±5.41 | 0.179 | 0.837 | (NS) |
| **Weight (kg)** | 80.68 (19.34) | 83.64 (20.27) | 82.56 (19.05) | 1.444 | 0.247 | (NS) |
| **Height (m)** | 1.66 (0.09) | 1.64 (0.1) | 1.67 (0.14) | 1.183 | 0.316 | (NS) |
| **BMI (Kg/m$^2$)** | 28.89 (4.06) | 30.73 (5.3) | 30.86 (7.5) | 1.663 | 0.202 | (NS) |

**Note:** Data are as mean (SD), NS= P> 0.05= not significant. Body mass index =BMI,
Spinal manipulation=SM, Mobilization with movement= MWM., 3×2 Mixed design MANOVA

## 1. Overall effect

The 3×2 mixed design MANOVA indicated that significant differences were ($P=0.005$; $P<0.05$) between the tested groups (the first independent variable) in all tested dependent variables; flexion ROM, pain intensity level, and Oswestry score. Moreover, significant differences ($P=0.0001$; $P<0.05$) were between the measuring periods (the second independent variable) in the tested dependent variables. Moreover, the interaction between the two independent variables was significant ($P=0.0001$; $P<0.05$), which indicated that the effect of the tested group (first independent variable) on the dependent variables was influenced by the measuring periods (second independent variable) (Table 2).

**Table 2: MANOVA for all dependent variables**

| Source of variation | F-value | P-value | Significant |
|---|---|---|---|
| **Tested groups effect** | 4.509 | 0.005 | S |
| **Measuring period effect** | 102.879 | 0.0001 | S |
| **Interaction effect** | 181.490 | 0.0001 | S |

## 2. Lumbar flexion ROM

2.1. Comparison of pre- and post-flexion ROM between the groups

Table (3) represents the mean values of lumbar flexion ROM within each group (A, B, and C).

2.2. Comparison of pre- and post-flexion ROM between the groups

A significant increase was in lumbar flexion ROM favor of group B than groups A and C (Table 3).

2.3. Bonferroni correction of post-lumbar flexion ROM between the groups

Mean differences between the groups showed that the spinal manipulation group (group B) had the highest scores in lumbar flexion ROM values (Table 4).

## 3. Pain intensity level

3.1. Comparison of pre- and post-pain intensity level between the groups

Table (3) represents the mean values of pain intensity level within each group (A, B, and C).

3.2. Comparison of pain intensity level between the groups A, B, and C

There was a significant improvement in the pain intensity level in favor of group B than group A and C.

3.3. Bonferroni correction of post-pain intensity level between the groups

Mean differences between the groups showed that the spinal manipulation group (group B) had the lowest scores in pain intensity level values (Table 4).

## 4. Oswestry score

4.1. Comparison of pre- and post-Oswestry score between the groups

Table (3) represents the mean values of the Oswestry score between the groups (A, B, and C).

4.2. Comparison of Oswestry score between the groups A, B, and C

A significant decrease was observed in the Oswestry score in favor of group B than groups A and C (Table 3).

4.3. Bonferroni correction of post-Oswestry score between the groups

Mean differences between the groups showed that the spinal manipulation group (group B) had the lowest scores in the Oswestry score values (Table 4).

**Table 3: Mean % of the change in groups, mean differences between the groups, and overall size effect on Flexion ROM, Pain intensity level and Oswestry Score.**

| Outcome | Scores | | | | | | Differences within groups Baseline – Post-intervention | | | Differences between groups | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Baseline | | | Post-intervention | | | | | | Overall effect [a] | | |
| | Group A Conventional | Group B (SM) | Group C (MWM) | Group A Conventional | Group B (SM) | Group C (MWM) | Group A Conventional | Group B (SM) | Group C (MWM) | F [b] | P-value [c] | Effect size [d] |
| **Flexion ROM** | 33.20 ±4.44 | 31.33 ±6.21 | 32.20 ±4.66 | 37.80 ± 3.46 (13.86%) | 44.47 ± 4.05 (41.94%) | 40.27 ± 3.24 (25.06%) | 4.60 (1.62-7.58) | 13.14 (9.20-17.05) | 8.07 (5.06-11.07) | 13.132 | 0.0001* | 0.45 |
| **Pain intensity level** | 6.93 ±0.88 | 6.67 ±0.90 | 6.80 ±0.77 | 4.20± 0.94 (39.39%) | 2.07± 1.03 (68.97%) | 2.87 ± 0.74 (57.79%) | 2.73 (2.05-3.41) | 4.60 (3.87-5.32) | 3.93 (3.36-4.50) | 20.867 | 0.0001* | 0.59 |
| **Oswestry Score** | 35.33 ±4.89 | 33.80 ±3.74 | 34.60 ±3.81 | 27.67± 3.24 (21.68%) | 12.73 ±3.86 (62.34%) | 17.47 ± 6.03 (49.51%) | 7.66 (4.56-10.77) | 21.07 (18.22-23.91) | 17.13 (13.35-20.90) | 42.370 | 0.0001* | 0.70 |

**Note:** Data are as mean, S=Significant= *P*-value < 0.05, NS= *P*> 0.05= not significant.
Spinal manipulation=SM, Mobilization with movement= MWM.

**Table 4: Bonferroni tests and means the difference between the groups.**

| | Mean difference | | | Bonferroni correction test | | |
|---|---|---|---|---|---|---|
| | Lumbar flexion ROM | Pain intensity level | Oswestry score | Lumbar flexion ROM | Pain intensity level | Oswestry score |
| **Group A vs. Group B** | 6.67 | 2.13 | 14.94 | 0.0001*(S) | 0.0001*(S) | 0.0001*(S) |
| **Group A vs. Group C** | 2.47 | 1.33 | 10.20 | 0.203(NS) | 0.001*(S) | 0.0001*(S) |
| **Group B vs. Group C** | 4.20 | 0.80 | 4.74 | 0.008*(S) | 0.063 (NS) | 0.020*(S) |

**Note:** Note: Data are as mean difference & confidence interval (CI 90%) and S=Significant= P-value < 0.05, NS= P> 0.05= not significant.

## Discussion

This study was done to test the impact of Spinal Manipulation with Mulligan lumbar mobilization on pain intensity level, spinal mobility, and functional impairment in patients with chronic NSLBP. Forty-five patients (24 male and 21 female) with chronic NSLBP were diagnosed by an orthopedic surgeon with a continuous duration of complaining more than three months, aged from 25 to 40 years, randomly assigned into three treatment groups. Group A (control group) received conventional physical therapy program including Superficial heating and spinal stabilization exercises (SSE). (Group B) received SSE and SM technique. (Group C) received SSE and MWM technique. The treatment was applied for 3 sessions per week for 4 consecutive weeks.

There were statistical differences between the 3 groups, where group B showed greater improvement in pain intensity level, functional impairment, and spinal mobility than the other two groups.

This finding was supported by Lehman and McGill who observed that SM resulted in significant improvement in ROM, but only in a single subject design [12]. Bialosky et al. reported an increase in ROM after zygapophyseal manipulation due to decrease in paraspinal spontaneous electromyographic activity and decreased hyperalgesia of paraspinal myofascial trigger points [13] Cramer G found that connective tissue adhesions develop in hypomobile facet joints, which would be associated with increased joint sounds and crepitus during motion. The facet joint surfaces separate during SM, which is sometimes accompanied by cavitation, and the separation is thought to break up the connective tissue adhesions and allow gaining of joint ROM [14]. SM is effective for some persons experiencing musculoskeletal pain [15]. Reductions in pain awareness or hypoalgesia following SM may indicate a mechanism for modulating central nervous system pain processing or afferent input. Identifying this mechanism can give insights into how SM generates clinical advantage. [16]. A study by Assendelft, which conducted in 12 sessions during 6 weeks of treatment, discovered that SM resulted in higher short-term pain relief and reduced disability [17].

## Conclusion

Within this study's scope, both manual therapy techniques, as well as SSE, were effective in increasing lumbar flexion ROM, decreasing pain intensity level, and improving functional impairment. Nonetheless, SM with SSE was shown to be superior over the MWM and SSE in terms of reducing pain intensity level, increasing ROM, and improving functional impairment in NSLBP.

## Limitations

This study was limited by the personal tendency of some individuals to aggravate the symptoms and thus affecting the natural performance.

## Recommendations for future researches

- Research should be conducted with a large sample.
- Further studies are needed to follow up patients after a long period of treatment.
- These findings may help physiotherapist in preparing rehabilitation program for patients with chronic NLBP.

## Conflicts of interest: None declared.

## Acknowledgment

Authors would like to thank all subjects who participated in this study.

## References

1. Anthony D, Steven ZG, Linda VD, Julie MW, Gwendolyn S, Paul S, Thomas RD, Joseph JG: Clinical Practice Guidelines Linked to The International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association J Orthop Sports PhysTher.(2012); 42(4): A1-A57.
2. Dvir Z, Keating JL. Trunk extension effort in patients with chronic low back dysfunction. Spine. 2003 Apr 1;28(7):685-92.
3. Gross A, Miller J, D'Sylva J, Burnie SJ, Goldsmith CH, Graham N, Haines T, Brønfort G, Hoving JL. Manipulation or mobilisation for neck pain: a Cochrane Review. Manual therapy. 2010 Aug 1;15(4):315-33.
4. Van Middelkoop M, Rubinstein SM, Kuijpers T, Verhagen AP, Ostelo R, Koes BW, van Tulder MW. A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. European Spine Journal. 2011 Jan 1;20(1):19-39.
5. Skyba DA, Radhakrishnan R, Rohlwing JJ, Wright A, Sluka KA. Joint manipulation reduces hyperalgesia by activation of monoamine receptors but not opioid or GABA receptors in the spinal cord. Pain. 2003 Nov 1;106(1-2):159-68.
6. Rubinstein SM, van Middelkoop M, Assendelft WJ, de Boer MR, van Tulder MW. Spinal manipulative therapy for chronic low‐back pain. Cochrane database of systematic reviews. 2011(2):CD008112. doi: 10.1002/14651858.CD008112.pub2.
7. Mulligan BR. Manual Therapy:" nags"," snags"," mwms" Etc. Wellington: Plane View Services; 1999; 40-53.
8. Mulligan BR. Manual therapy: ''NAGS'', ''SNAGS'', ''MWM's''etc. 5th ed. New Zealand Plane View Services Ltd, 2003; 51-66.
9. Fairbank JC, Pynsent PB. The Oswestry disability index. Spine. 2000 Nov 15;25(22):2940-53.
10. Berryman Reese N, Bandy WD. Joint range of motion and muscle length testing. St Louis, MO: Saunders. 2002; PP 112-124.
11. Kisner C, Colby LA, Borstad J. Therapeutic exercise: Foundations and techniques. Fa Davis; 2017 Oct 18.
12. Lehman GJ, McGill SM. Spinal manipulation causes variable spine kinematic and trunk muscle electromyographic responses. Clinical Biomechanics. 2001 May 1;16(4):293-9.
13. Bialosky JE, Bishop MD, Robinson ME, Zeppieri Jr G, George SZ. Spinal manipulative therapy has an immediate effect on thermal pain sensitivity in people

with low back pain: a randomized controlled trial. Physical therapy. 2009 Dec 1;89(12):1292-303.

14. Cramer GD, Henderson CN, Little JW, Daley C, Grieve TJ. Zygapophyseal joint adhesions after induced hypomobility. Journal of manipulative and physiological therapeutics. 2010 Sep 1;33(7):508-18.
15. Childs JD, Fritz JM, Flynn TW, Irrgang JJ, Johnson KK, Majkowski GR, Delitto A. A clinical prediction rule to identify patients with low back pain most likely to benefit from spinal manipulation: a validation study. Annals of internal medicine. 2004 Dec 21;141(12):920-8.
16. Staahl C, Olesen AE, Andresen T, Arendt-Nielsen L, Drewes AM. Assessing analgesic actions of opioids by experimental pain models in healthy volunteers–an updated review. British journal of clinical pharmacology. 2009 Aug 1;68(2):149-68.
17. Assendelft WJ, Morton SC, Emily IY, Suttorp MJ, Shekelle PG. Spinal manipulative therapy for low back pain: a meta-analysis of effectiveness relative to other therapies. Annals of internal medicine. 2003 Jun 3;138(11):871.