



EFFECTS OF INVERSION TABLE THERAPY VERSUS MULLIGAN TECHNIQUES ON PAIN AND LUMBAR FLEXIBILITY IN PATIENTS WITH CHRONIC LOW BACK PAIN

Faiz Ur Rehman^{1*}, Asima Arshad¹, Qurba Kiran¹

¹Department of Rehabilitation Sciences, Faculty of Allied Health Sciences, The Superior University, Lahore, Pakistan

 ***Corresponding Author:** Faiz Ur Rehman, Department of Rehabilitation Sciences, Faculty of Allied Health Sciences, The Superior University, Lahore, Pakistan

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ABSTRACT

Background: The Chronic low back pain (CLBP) is a prevalent yet difficult to manage and to treat public wellbeing with a significant treatment failure rate. Both inversion table therapy and mulligan techniques are very effective in reducing low back pain. A number of literatures supports the effectiveness of both techniques individually but there is no literature available that provide comparison between these two techniques.

Objective: To finding the effectiveness of inversion table therapy vs. mulligan techniques on pain and lumbar flexibility among patients with chronic low back pain.

Methodology: A double-blinded RCT was conducted in different private setups of Lahore. It comprised patients of both gender aged 30 to 50years. They was randomized into two equal groups having same baseline treatment. Group 1 Experimental group was exposed to Inversion Table Therapy. Group 2 control group was exposed to Mulligan Technique. Pain was assessed by NPRS and to identify level of disability or severity of lower back pain ODI will be used, Sit and Reach test were used to measure lumbar flexibility through flexing lumbar spine and Rand SF-36 is a questionnaire was used to assess the quality of life. For data analyzation SPSS 26 version was used.

Results: For between-group comparisons, the null hypothesis was kept for NPRS and RAND-36 (as $p > 0.05$), whereas the alternative hypothesis was accepted for ODI and SRT (as $p < 0.05$).

Conclusions: To conclude, the null hypothesis for within-group comparisons was rejected because both treatments significantly improved outcomes within each group. The Mulligan Technique was better at lowering impairment in people with persistent low back pain, but Inversion Table Therapy was better at increasing flexibility overall.

KEYWORDS

Inversion table therapy, Mulligan Technique, Lumbar flexibility, William Flexion, Chronic Low Back pain.



INTRODUCTION

The myofascial pain, facet joints pain associated sacroiliac joint and discogenic pain, spinal stenosis and unsuccessful spinal surgeries are among the etiologies of low back pain. Neurological symptoms like radiculopathy can often lead to back pain [1]. Many other conditions can cause LBP such as spondylolysis, bulging or herniated inter vertebral discs, apophysitis of iliac crest, muscular strain or spasm and functional pain syndrome like fibro-myalgia. Different types of conditions can lead to low back pain according to the cause [2]. Radiating pain down the leg, low back pain (LBP) may be nociceptive (referred) pain instead of neuropathic (caused by injury or illness of the nervous system). Regretfully, individuals experiencing leg discomfort associated with their low back are frequently diagnosed with multiple conditions, such as sciatica, radiculopathy, and pseudo-radicular pain [3].

Individuals experiencing acute low back pain who do not receive appropriate diagnosis and treatment might progress to chronic pain that may enhance the probability of disability, diminishes the quality of life, and restrict the active participation in daily livings. Once the symptoms provokes and worsening within a year, about 20 percent of the population started to have chronic low back pain following low back pain. Most of the low back pain is mechanical in nature and can be brought on by radiculopathy, sciatica, spinal stenosis, spondylolisthesis, trauma, scoliosis, sprain and strain, inter vertebral disc -degeneration and herniation or ruptured discs and abnormal lordotic curves [4]

Trunk muscles strength also affects low back. Muscle strength declines with chronic low back pain. Tightness in muscles also effects lumbar flexibility which then leads towards low back pain [5]. Structure and function of the low back muscles is very important in order to get benefit from the treatment. Reduced functions and weakness associated with muscles leads to further complications in low back pain [6]. Lumbar or pelvic muscles weakness, shortening or rigidity can lead to dysfunction causing low back discomfort [7]. The inter-vertebral discs (IVDs) and the surrounding muscles and ligaments provide the spine stability; the muscles provide extrinsic support, while the ligaments and discs provide intrinsic stability. There are five vertebrae (L1–L5) in the lumbar spine, while some people sporadically have six. Examining the sacroiliac joints is crucial when patient presents with persistent low back pain since lumbar spine and beginning of the sacral spine (S1) comprise the lower back [4].

The first-line treatment for LBP that is most commonly utilized is over-the-counter analgesics. According to current standards, the initial suggested treatment for nonspecific low back pain should be over-the-counter drugs. According to recent research, NSAIDs, acetaminophen, opioids, muscle relaxants, and antidepressants are all useful therapies for CLBP. Topical creams and Trans-cutaneous electrical nerve stimulation are also helpful in relieving chronic low back pain [8].

Different kinds of interventions work to provide benefit. Patients with persistent low back pain may benefit from exercise therapy if they can move their entire body, contract particular muscle groups voluntarily, engage in activities that enhance postural musculature, stabilize, and improve neuro coordination, or any combination of these. With the intention of reducing discomfort, improving function, hastening the patient's recovery, and enabling them to resume their regular activities, these physical therapies work to strengthen the muscles and joints and enhance muscular function and range of motion [9].

The treatment for back pain with inversion table therapy (ITT) is also beneficial. It is a form of spinal traction which may limit low back pain because of the gravity facilitated traction of the spine which distracts the lumbar vertebrae [5]. In inversion table therapy patient is laid in position upside down or at an angle while hanging the lower limb with the aim of therapeutic remunerations. In past days inversion table therapy had been used to gain health benefits. The Archaeologist, in 3000 BC discovered that human used Yoga inversion postures in their drawings. To re-balance the body they used inverted postures of body, to improve the blood circulations, stimulation of the brain and to relieves pressure on abdominal viscera. To harness the force of gravity in strengthen to stretch patient and to release the postural discomfort, the Father of Medicine, Hippocrates ties up a patient on ladder with ropes and pulley in 400 BC [4].

Evidence shows that during rehabilitation exercise therapy is also beneficial in patients with low back pain. Williams flexion exercise (WFE) is one of the most basic and widely utilized physiotherapy exercises for treating lower back pain (LBP) patients among the various exercises. It has been demonstrated that by strengthening the para spinal muscles to support the deteriorated facet joints, it can lessen pain and increase spinal range of motion (ROM) in LBP patients. Coordination and strengthening exercises are also beneficial for patients with low back pain Williams flexion and McKenzie exercises are proved to be beneficial for mechanical low back pain treatments[2]

Mulligan and Maitland mobilizations are two of the manual treatment methods commonly used in physiotherapy to treat joint dysfunction and regain mobility for the patients suffering from CLBP. Mulligan mobilization, originated by Brian Mulligan, allows patients with musculoskeletal ailments, especially spinal abnormalities, to experience instant symptom relief and pain-free functional gains by combining prolonged passive accessory mobilizations with active physiological movements. Its basic idea is to improve proprioceptive feedback and correct positioning errors by including the patient actively in the mobilization process [10].

NAGs (natural apophyseal glides), "SNAGs" (sustained natural apophyseal glides), and "SMWLMs" (spinal mobilizations with limb movements) are some of the treatment techniques which may be implement to the mobilize the spine as part of the Mulligan concept. These techniques can help correct dysfunctional movement [11]. According to Mulligan's theory, pain results from a small joint positioning defect that causes limitation. Postural defect leads to biomechanical modification leading to pain. The spine's natural apophyseal glide is maintained during Mulligan mobilization, and the extremities move as a result. Individuals are prompted to do anatomical movements while spinous and transverse processes undergo passive accessory movement. Mulligan mobilization is based on the idea that movement should be painless [12]

The pain gate mechanism is activated when large-diameter nerve fibers are triggered by spinal mobilization of mechanical detectors. At the central level, the periaqueductal grey matter of the midbrain may enhance descending pain pathways. The principal mediators,



opioids, noradrenaline, and serotonin, may be released by these descending neurons, modifying pain, decreasing muscle spasm, and increasing restricted lumbar movements [13].

To compare the effects of inversion table therapy versus Mulligan techniques on pain and lumbar flexibility to manage chronic low back pain.

To ascertain which type of exercise training program (Inversion Table Therapy versus Mulligan Techniques on pain and lumbar flexibility) in better enhancing quality of life with evidence-based suggestions for treatment of chronic low back pain.

METHODOLOGY

This study was conducted as a double-blinded randomized controlled trial. A total sample size of 54 participants was calculated using EPITOOLS with a 95% confidence level and an acceptable error of 2, and participants were equally allocated into two groups with 27 individuals in each group. A non-probability convenience sampling technique was used, in which participants were selected based on accessibility, availability, proximity, and willingness to participate. Data were collected from Omer Hospital and Pain Rehabilitation Clinic over a period of six months following approval from the Ethical Review Committee.

Both male and female participants aged 30–50 years with idiopathic low back pain persisting for more than three months were included, while pregnant females, patients with cauda equina syndrome, recent cardiovascular disease, progressive neurological deficits, history of vertigo or glaucoma, flexion-biased pain, persistent use of pain medication, or those who had undergone other medical interventions such as acupuncture or physical therapy in the last three months were excluded.

Data were collected using the Numerical Pain Rating Scale, Oswestry Disability Index, Sit and Reach Test, and RAND SF-36 Health Survey. Participants were recruited and randomly assigned to Group A and Group B using a randomization table to minimize selection bias. A double-blinded approach was maintained in which both the participants and the therapist were unaware of group allocation. The experimental group received Inversion Table Therapy, while the control group was treated using the Mulligan technique.

RESULTS

The study included 54 participants, evenly distributed by gender (46% male, 54% female) and with a mean age of 38.57 ± 4.98 years, indicating minimal bias from age or gender differences between the two treatment groups: Inversion Table Therapy (Group A) and Mulligan Technique (Group B).

The Wilcoxon Signed Rank Test revealed statistically significant improvements ($p = .000$) in lumbar flexibility (measured by the Sit and Reach Test), functional impairment (measured by the ODI), pain intensity (measured by the NPRS), and quality of life (measured by the RAND-36) for both treatment groups, indicating successful management of symptoms and function in patients with persistent lower back pain.

Results of the Mann-Whitney U Test indicated that the Mulligan Technique significantly improved functional disability (ODI, $p = 0.046$), while Inversion Table Therapy significantly enhanced lumbar flexibility (SRT, $p = 0.001$). Both therapies showed no significant differences in pain (NPRS, $p = 0.581$) and quality of life (RAND-36, $p = 0.322$), suggesting that while both interventions improved outcomes, the Mulligan Technique was superior for functional recovery and Inversion Table Therapy excelled in flexibility improvement.

Table4.1: Age & Gender of Participants

Variables	N (Both Groups)	Mean	Std. Deviation
Age	54	38.57	4.985
Gender	54	1.54	0.503
Valid N (list wise)	54		

Table no 1 shows the mean and std. deviation of age & Gender of participants of both group A and B. Mean $\pm$ std. deviation of age was 38.57 and 4.985 while the mean $\pm$ std. deviation of gender was 1.54 and 0.503.

Table 4.2: Tests of Normality

Tests of Normality				
Shapiro-Wilk Test				
	Group	Statistics	Df	Significance (pvalue)
NPRS pre test	1	.907	27	.019
	2	.904	27	.016
NPRS post test	1	.860	27	.002





	2	.835	27	.001
NPRS change test	1	.856	27	.001
	2	.909	27	.021
ODI pre test	1	.941	27	.129
	2	.977	27	.796
ODI post test	1	.941	27	.128
	2	.930	27	.067
ODI change test	1	.955	27	.275
	2	.937	27	.105
Sit and reach pre test	1	.908	27	.021
	2	.936	27	.100
Sit and reach post test	1	.901	27	.014
	2	.892	27	.009
Sit and reach change test	1	.970	27	.591
	2	.956	27	.301
RAND-36 Pre test	1	.951	27	.231
	2	.965	27	.466
RAND-36 Post test	1	.902	27	.015
	2	.947	27	.186
RAND-36 change test	1	.910	27	.023
	2	.890	27	.008

In normality (Shapiro–Wilk), p-values are indicating data are not normally distributed for the NPRS, RAND-36, and some Sit-and-Reach variables. Hence, nonparametric tests includes Wilcoxon and Mann–Whitney tests were correctly used for within the group changes and between the group comparisons respectively.

Table 4.3: Within Group Analysis (Wilcoxon Signed Ranks Test)

GROUP 1 (Inversion Table Therapy)				
	NPRS Post NPRS Pre	ODI Post ODI Pre	SRT Post SRT Pre	RAND-36 Post - RAND-36 Pre
Z	-4.592	-4.546	-4.549	-4.545
Asymp. Sig(2-tailed)	.000	.000	.000	.000



GROUP 2 (Mulligan Technique)				
	NPRS Post NPRS Pre	ODI Post ODI Pre	SRT Post SRT Pre	RAND-36 Post - RAND-36 Pre
Z	-4.600	-4.544	-4.551	-4.553
Asymp. Sig(2-tailed)	.000	.000	.000	.000

Table no 3 shows mean differences of pain, level of disability, flexibility & quality of life before and after the intervention shows significant improvement. Both Group 1 and Group 2 had $p = .000$ for all outcomes (NPRS, ODI, SRT, RAND-36), so both treatment techniques were significantly effective within their groups.

Table 4: Between-group Analysis (Mann-Whitney Test)

RANKS				
	Group	N	Mean Rank	Sum of Ranks
NPRS change	1	27	28.63	773.00
	2	27	26.37	712.00
	Total	54		
ODI change	1	27	23.24	627.50
	2	27	31.76	857.50
	Total	54		
SRT change	1	27	34.83	940.50
	2	27	20.17	544.50
	Total	54		
RAND-36 change	1	27	25.39	685.50
	2	27	29.61	799.50
	Total	54		

TEST STATISTICS				
	NPRS change	ODI change	SRT Change	RAND-36 change
Mann-Whitney Test	334	249.500	166.500	307.500
Wilcoxon Signed Ranks Test	712	627.500	544.500	685.500
Z	-.552	-1.994	-3.444	-.989
Asymp. Sig(2-tailed)	.581	.046	.001	.322

The above table compares the change scores between two groups in order to know the amount of improvement. If $p\text{-value} = < 0.05$, the difference between treatments is significant, meaning one group improved more (alternative hypothesis accepted). From data it is concluded that both group 1 and 2 treatments were equally effective in pain reduction and function in chronic low back pain. While



Inversion Table Therapy proved to be more effective in improving lumbar flexibility (SRT) and Mulligan Technique) in reducing level of functional disability (ODI) in chronic low back pain.

DISCUSSION

This study compared the benefits of Mulligan Techniques and Inversion Table Therapy on lumbar flexibility and pain among individuals with persistent low back pain. Within each group, the results showed that both treatment approaches significantly enhanced lumbar flexibility (SRT), functional status (ODI), pain intensity (NPRS), and quality of life (RAND-36) ($p = .000$). Between-group comparison, however, revealed that the Mulligan Technique improved functional impairment ($p = 0.046$) more than Inversion Table Therapy improving lumbar flexibility ($p = 0.001$). There were not significant differences in the groups' levels of pain or quality of life.

The current study confirmed the effectiveness of both interventions for chronic low back pain (CLBP) by showing that both Mulligan Techniques and Inversion Table Therapy significantly improved pain, flexibility, functional ability, and quality of life within each group. However, a substantial difference was found between the groups in terms of lumbar flexibility (SRT) and functional disability (ODI), with inversion therapy yielding higher increases in lumbar flexibility and Mulligan demonstrating greater recovery in functional disability. These findings are consistent with past research showing that spinal traction-based and mobilization-based approaches can both improve spine mobility and lessen symptoms, while their main therapeutic effects may vary.

In a similar vein, Mendelow et al. (2021) discovered that inversion therapy decreased the requirement for surgery in individuals with discogenic disorders while improving spinal function and pain. These results support the idea that inversion's gravitational pull and spinal decompression effect may alleviate intervertebral compression, resulting in increased flexibility and stretch tolerance. Thus, the decompression and elongation of spinal and paraspinal structures brought about by inversion can be credited with the higher Sit and Reach Test (SRT) scores in the inversion group of the current study [14].

The results of Tanabe et al. (2021), who discovered that lumbar traction or inversion therapy improved within groups but did not always produce superior between-group effects compared with other manual therapy interventions, are consistent with the findings of inversion therapy, which demonstrated superior flexibility outcomes but the effects on pain and functional disability were not significantly greater than Mulligan techniques [15].

Cheng et al. (2020) also found that mechanical traction produced modest long-term functional improvement but short-term discomfort relief. According to Veltri, inversion helps with mechanical decompression, but its long-term effects on pain perception may be limited when compared to active mobilization-based therapies. Veltri also noted beneficial but statistically non-significant changes in flexibility. [16].

The Oswestry Disability Index (ODI) improved more in the Mulligan Technique group of the current study, indicating a better improvement in functional capacity. The findings of Javaherian (2017), Khan (2018), and Nasir (2018), who showed that Mulligan SNAGs (Sustained Natural Apophyseal Glides) significantly improved pain reduction, range of movement, and daily functional performance in patients with CLBP, provide strong support for these conclusions [17].

Using Mulligan mobilizations, Solangi (2025) also verified notable post-treatment decreases in pain and impairment, supporting the idea that these methods correct minor positioning errors and restore facet joint alignment, resulting in functional recovery. Thus, Mulligan's better ODI outcomes in this study are in line with the idea that movement-based mobilization enhances neuromuscular coordination and joint mechanics [18].

A number of studies also highlighted the biomechanical and neurophysiological justification for Mulligan's efficacy. According to Hussien (2017) and Bhat (2021), SNAGs dramatically improved lumbar flexion and functional ratings when used in conjunction with conventional therapy, outperforming soft tissue methods such as myofascial release. According to the results of the current study, both groups made considerable internal improvements, although Mulligan's functional outcomes were somewhat better. The hypothesis that Mulligan mobilizations improve overall function by facilitating muscle activation and movement correction in addition to modulating pain perception is supported by this study [13].

In contrast, the between-group difference in pain (NPRS) was not significant in this trial, despite the fact that both therapies considerably decreased pain within groups. This outcome differs from certain earlier conclusions. In terms of conditioned pain modulation and pain intensity, for instance, Pozas (2025) found that mobilization with movement had small effect sizes and no significant differences when compared to sham mobilization. This suggests that manual therapy has less pronounced effects than those seen in the current study [19].

CONCLUSIONS

There were 54 participants in the study, with a balanced gender distribution and an average age of 38.57 ± 4.98 years. Since the Shapiro-Wilk test revealed that the majority of the variables were not normally distributed ($p < 0.05$), non-parametric tests were used, including the Mann-Whitney U and Wilcoxon Signed Rank tests.

Both Group A (Inversion Table Therapy) and Group B (Mulligan Technique) demonstrated statistically significant improvement ($p = .000$) in all outcome measures (NPRS, ODI, Sit and Reach Test, and RAND-36) according to within-group analysis, suggesting that both interventions were successful in lowering pain and enhancing flexibility, functional ability, and quality of life.

The Oswestry Disability Index ($p = 0.046$) and Sit and Reach Test ($p = 0.001$) showed statistically significant differences in improvement between the two groups, according to between-group analysis using the Mann-Whitney U test. While the higher mean rank for the Sit and Reach Test in Group A demonstrated that Inversion Table Therapy caused more gains in lumbar flexibility, the higher mean rank for the ODI in Group B suggested that the Mulligan Technique was more effective in improving functional





impairment. Similar effects on pain and quality of life were shown by the RAND-36 ($p = 0.322$) and NPRS ($p = 0.581$), which did not indicate any significant differences between groups.

To conclude, the null hypothesis for within-group comparisons was rejected because both treatments significantly improved outcomes within each group. For between group comparisons, the null hypothesis was kept for NPRS and RAND-36 (as $p > 0.05$), whereas the alternative hypothesis was accepted for ODI and SRT (as $p < 0.05$). The Mulligan Technique was better at lowering impairment in people with persistent low back pain, but Inversion Table Therapy was better at increasing flexibility overall.

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