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Mulligan Traction Straight Leg in Patients wth Chronic Low Back Pain and Hamstring Tightness

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Abstract

Low back pain is a worldwide problem affecting quality of life and is one of the most common reasons for seeking medical consultations. This study aimed to compare the effects of Mulligan traction straight leg raise and slump stretching on pain, disability, and hip range of motion in patients with chronic low back pain and hamstring tightness. Forty-eight patients with chronic low back pain and hamstring tightness were randomly divided into two groups, Group A: Mulligan Straight Leg Raise Technique and Group B: Slump Stretching. The outcome measures included pain, disability, and hip range of motion, measured using the Visual Analogue Scale, Oswestry Disability Index, and Goniometer. Data were collected at baseline, in 4th week, and in the 8th week. The results of the current study indicated that Slump stretching is more effective in treating patients with chronic low back pain and hamstring tightness as compared to the Mulligan SLR technique with a P value <0.001. Slump stretching may be a better technique compared to Mulligan SLR to improve pain, Hip ROM, and disability in patients with chronic low back pain with hamstring tightness.

1. Introduction

Chronic low back pain is a major health problem with broad economic and social costs (Maher et al., 2004; Rosolek et al., 2025). It occurs in similar proportions in all cultures, interferes with quality of life and work performance, and is most

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common reason for medical consultations. Approximately 10%–20% of patients with Low back pain develop chronic low back pain, defined as pain and disability persisting for more than 3 months. These patients use more than 80% of all healthcare costs for back trouble, and treatment for this group has a low success rate. Low back pain is a worldwide problem with a lifetime prevalence reported to be as high as 84% by WHO (Tambekar, Sabnis, Phadke, & Bedekar, 2016).

Chronic low back pain usually refers to pain lasting more than 12 weeks and is associated with physical pain and fatigue from daily activities; it causes mental distress such as stress, depression, anxiety, impaired performance, and sleep disorders. The causes of low back pain include changes in lifestyle habits, alterations in the work environment, a lack of exercise among modern people, and muscle weakness and decreased flexibility resulting from an imbalance of the muscles surrounding the lumbar region. Among the epidemiological causes of low back pain, the most significant is spinal instability, which leads to pain, decreased endurance, reduced flexibility, and limitations in the range of motion of the lower back, ultimately progressing to a chronic state. As the cross-sectional area of the muscles around the spine decreases, irreversible atrophy occurs (Maher et al., 2004). LBP can be categorized as acute (pain lasting less than 6 weeks), sub-chronic (pain lasting between 6 and 12 weeks), or chronic (more than 12 weeks).

As the hamstrings and lumbar extensors have their muscular origin in the pelvis, there may be a possible relationship among these structures. So, weakness or inflexibility of one structure may correspondingly change the strength and position of the other to maintain pelvis control, which may lead to the development of low back pain. Additionally, individuals with shortened hamstrings often experience walking difficulties, face a higher risk of developing musculoskeletal problems (Reis & Macedo 2015), and more susceptible to developing osteoarthritis of the knee in the aging process (Nouman et al., 2024).

There are many conservative treatments for low back pain from over-the-counter medication to self-taught exercises, alternative medicine, and physical therapy. Conventional Physiotherapy for low back pain includes exercises to strengthen the back and abdominal muscles, manual therapy and education on proper posture and body mechanics. Mulligan technique is one of the effective manual therapy maneuvers in chronic low back patients. Brian Mulligan developed the concept based on his clinical experiences and the influences of noted physical therapists. Mulligan mobilization with movement (MWM) is a particular therapeutic method that combines accessory mobilization with physiological motion. When there is a limitation due to hamstring tightness or low-back dysfunction, the Mulligan traction straight leg raise (TSLR) approach has been proposed as an alternate treatment to improve the range of straight leg raise (SLR) (Baker, Nasypany, Seegmiller, & Baker,2013).

Stretching is a type of physical activity in which a particular muscle, tendon, or muscle group is purposefully flexed or stretched to increase the muscle's perceived flexibility and achieve a comfortable level of muscular tone (Saleem et al., 2025). Increased muscular control, flexibility, and range of motion are the effects.

Stretching is further applied medically to relieve cramps and enhance everyday function by extending the range of motion (Câmara-Gomes et al., 2022). In physical therapy, stretching exercises are of great importance in treating disabilities and reducing pain associated with chronic musculoskeletal conditions (Antohe et al., 2024). It has been shown to have a positive effect on chronic low back pain.

In a study on modeling the effect of static stretching and strengthening exercise in low back pain subjects with shortened hamstrings, it was found that static stretching exercise was proven to be more effective than muscle strengthening exercise and significantly improved their balance in low back pain patients with hamstring tightness (Shamsi, Mirzaei, Shahsavari, Safari, & Saeb, 2020).

A study conducted by Widiatmi and Sari (2021) described the Slump test as a neurodynamic test that evaluates the mechanical sensitivity of the neuromeningeal structures within the spinal canal. This study was a case report that observed 12 patients with chronic low back pain (LBP), divided into two groups. Twelve individuals were divided into two groups out of fifty patients with a diagnosis of persistent myogenic LBP. On average, 11 out of 12 patients reported less pain and more functional activity. In Group 1, there was a 9.1-point drop in pain and a 12.3% increase in functional activity. In contrast, in group 2, there was a 3-point reduction in pain and a 2.33% gain in functional activity.

A study conducted by Suharto, Sudaryanto, Erawan, and Saleng (2023) compared the effectiveness of spinal mobilization with leg movement (SMWLM) and traction straight leg raise (TSLR) in patients with herniated nucleus pulposus and limited range of motion, as well as lumbar dysfunction. A total of 24 patients with nucleus pulposus hernia were randomized into 2 groups, The results showed that spinal mobilization with leg movement and traction straight leg raise have significant effects in improving range of motion and lumbar function in patients with herniated nucleus pulposus, but spinal mobilization with leg movement is more effective than traction straight leg raise in increasing range of motion and lumbar function in patients with disc herniation (12).

2. Materials and methods

The aim of the current study was to compare two non-invasive treatment techniques: Mulligan traction, straight leg raise, and slump stretching. This study enhanced the treatment approach for low back pain by exploring conventional treatments and combining interventions that target pain, range of motion, and disability, thereby providing a more comprehensive approach to managing low back pain.

Study Design and Settings

The study was a randomized, single-blind, parallel two-arm clinical trial. The trial was registered in ClinicalTrials.gov Identifier with registration number NCT05779891 that was conducted from March 7, 2023 to June 30, 2023. Eligible patients were enrolled from the physiotherapy department of District Headquarters Hospital Faisalabad, Punjab, Pakistan.

Participants:

After obtaining informed consent, forty-eight patients were enrolled in the study, based on the inclusion and exclusion criteria. Patients who had low back pain for three months, with an active positive knee extension test, and had been sitting for three hours were included in this study. Patients who had any history of trauma or any active infection, tumor, tuberculosis, or intervertebral disc prolapse were excluded from the study (Deyo et al., 2015).

They were randomly assigned to two equal groups through a computer-generated random number table. Patients in both groups received the same conventional physiotherapy, which consisted of a 10-minute hot pack application to the lower back, followed by a 10-minute ultrasound treatment at 1.5 W/cm². After baseline treatment, Group A, the Mulligan straight leg raise group, underwent the Mulligan straight leg raise technique. Three repetitions of Mulligan's Traction Straight Leg Raise were done with seven seven-second hold and a five-second relaxation time. The duration of total treatment protocol was 30 minutes. Group B received hot pack at the lower back for 10 minutes, followed by an ultrasound at 1.5w/cm2 for 10 minutes.

The treatment was preceded by Slump Stretching technique. Five repetitions of the Slump stretching technique were performed with 30 30-second hold and 5-second relaxation interval. The total treatment protocol lasted 30 minutes.

The assessment of patients was done at baseline, at the 4th and 8th weeks. The outcome measures were pain measured by using Visual Analogue Scale (VAS), range of motion (ROM) measured by Goniometer and disability measured by Oswestry disability index (ODI). VAS is a pain measuring scale for pain measurement where pain is presented, on a scale of 0 to 10 points, where 0 represents "no pain" and 10 represents severe pain (Carlsson et al., 1983; Miller & Ferris, 1993; Johnson et al., 2005).

A goniometer is an instrument that measures angles or enables the measurement of an object. Rotate in precise angular positions. Range of outcomes measured using 3D activity classifications such as bilateral flexion, extension, lateral rotation, and lateral flexion (Shamsi, Mirzaei, & Khabiri, 2019). The Oswestry Disability Index is a self-assessment questionnaire consisting of 10 items, each with 6 response points that can be scored from 0 to 5. The total score, expressed as a percentage of disability, can be calculated as follows: the score is divided by 50 and then multiplied by 100. The following values are used to measure response to this scale: from 0 to 20% (less disability); from 20 to 40% (moderate disability); from 40 to 60% (severe disability); from 60 to 80% (disabled) and more than 80% (subject is bedridden) (Davidson & Keating, 2005; Yates & Shastri-Hurst, 2017).

3. Results and Discussions

In this comparative experimental study, 48 patients with prolonged sitting posture, hamstring tightness, and low back pain were randomized into two groups.

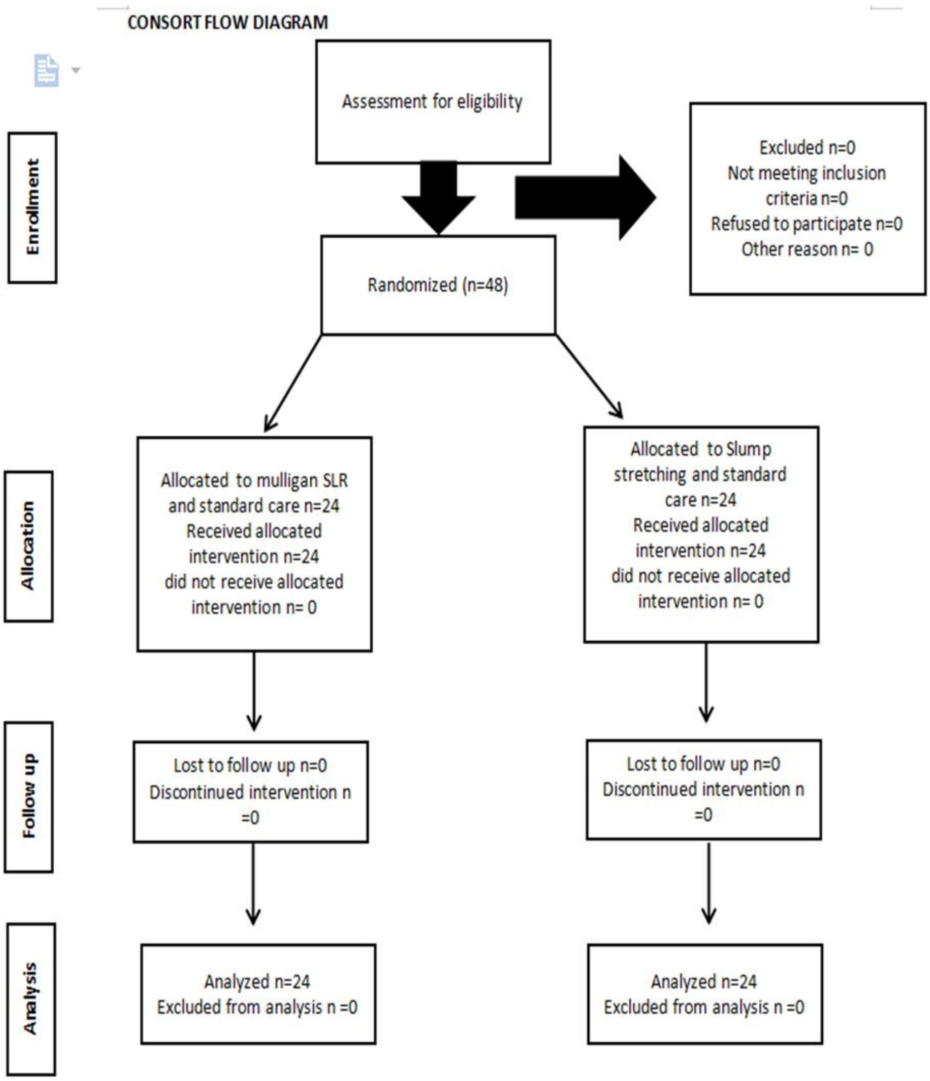

Figure 1. *Consort flow diagram*

Patients in Group A received Mulligan Traction Straight Leg Raise Technique for 8 weeks, with 3 sessions per week, and Patients in Group B received slump stretching for 8 weeks, also with 3 sessions per week.

The age ranges, means, and standard deviations (SDs) for both groups indicated that the mean ages and SDs were comparable between Group A and Group B. Additionally, the gender distribution of patients revealed no statistically significant differences between the two groups.

Table 1. *Within group difference of Hip Flexion at baseline, 4th week and 8th week*

		Descriptive Statistics of Hip Flexion					
		SLR Group			**SLUMP Group**		
	N	**Mean**	**Std. Deviation**		**Mean**	**Std. Deviation**	
Baseline	24	37.708	6.423		40.791	11.654	
4th Week	24	49.500	9.842		59.458	8.777	
8thWeek	24	63.416	9.458		74.750	8.522	
F Value		210.579			255.168		
P value		<.001			<.001		
	Paired Difference						
		Mean	**Std. Error**	**P value**	**Mean**	**Std. Error**	**P value**
4th week		11.792	2.382	<.001	18.667	2.021	<.001
4th Week to 8th week		13.917	.782	<.001	15.292	0.731	<.001
Baseline to 8th week		25.708	2.261	<.001	33.958	2.131	<.001

A multi-repeated ANOVA was used for within-group comparisons. The mean ±SD for hip flexion in SLR group was as follows: at baseline (37.708 ±6.423), 4th week (49.500±9.842) and at 8th week (63.416±9.458) with F value (210.579) whereas in SLUMP group the mean± SD were as follows, at baseline (40.791 ±11.654), after 4th week (59.458±8.777) and after 8th week (74.750±8.522) with F value (255.168) and showed significant p value (<.001). Mean difference in SLUMP group at baseline to 4th week (18.667), 4th week to 8th week (15.292) and baseline to 8th week (33.958) with significant p value (<.001).

Table 2. *Within group difference of ODI at baseline, 4th week and 8th week*

		Descriptive Statistics of ODI					
		SLR Group			**SLUMP Group**		
	N	**Mean**	**Std. Deviation**		**Mean**	**Std. Deviation**	
Baseline	24	24.875	9.218		23.083	7.222	
4th Week	24	19.541	8.324		17.458	4.791	
8thWeek	24	9.916	3.091		12.625	3.560	
F Value		51.186			30.910		
P value		<.001			<.001		
	Paired Difference						
		Mean	**Std. Error**	**P value**	**Mean**	**Std. Error**	**P value**
Baseline to 4th week		5.333	0.592	<.001	5.625	.844	<.001
4th Week to 8th week		9.625	1.554	<.001	4.833	.706	<.001
Baseline to 8th week		14.958	1.733	<.001	10.458	1.305	<.001

A multi-repeated ANOVA was conducted for within-group comparisons. In the SLR group, the Oswestry Disability Index (ODI) demonstrated the following means ± SD: at baseline (24.875 ± 9.218), after 4 weeks (19.541 ± 8.324), and after 8 weeks (9.916 ± 3.091). The analysis yielded an F value of 51.186, indicating a statistically significant p-value of less than 0.001. The mean differences observed in the SLR group were significant, with decreases from baseline to the 4th week (5.333), from the 4th week to the 8th week (9.625), and from baseline to the 8th week (14.958), all with p-values < .001.

Similarly, in the SLUMP group, the ODI means ± SD were recorded as follows: at baseline (23.083 ± 7.222), after 4 weeks (17.458 ± 7.222), and after 8 weeks (12.625 ± 3.560). The F-value for this group was 30.910, resulting in a significant p-value of < .001. The mean differences in the SLUMP group were also significant, with reductions from baseline to the 4th week (5.625), from the 4th week to the 8th week (4.833), and from baseline to the 8th week (10.458), all showing p-values < .001.

Table 3. *Within group difference of Hip extension at baseline, 4th week and 8th week*

		Descriptive Statistics of Hip Extension					
		SLR Group			**SLUMP Group**		
	N	**Mean**	**Std. Deviation**	**Mean Rank**	**Mean**	**Std. Deviation**	**Mean Rank**
Baseline	24	8.333	3.185	1.73	6.875	2.878	1.23
4th Week	24	7.625	1.813	1.44	9.583	1.931	1.81
8th Week	24	12.833	1.970	2.83	14.291	1.267	2.96
X^2		26.860			38.344		
P value		<.001			<.001		
	Paired Difference						
		Test Statistic	**S.E**	**P value**	**Test Statistic**	**S.E**	**P value**
Baseline to 4th week		0.292	.289	.312	1.146	.289	<.001
4th Week to 8th week		1.104	.289	<.001	.583	.289	<.001
Baseline to 8th week		1.396	.289	<.001	1.729	.289	.043

Friedman's test results showed a within-group difference for Hip extension at baseline, at the 4th week, and at the 8th week post-intervention, a significant improvement in both groups with a P value of <.001. Chi square values in SLR group and SLUMP group were (26.869) and (38.344), respectively.

Table 4. *Within group difference of Visual Analogue Scale at baseline, 4th week and 8th week*

		Descriptive Statistics of Visual Analogue Scale					
		SLR Group			**SLUMP Group**		
	N	**Mean**	**Std. Deviation**	**Mean Rank**	**Mean**	**Std. Deviation**	**Mean Rank**
Baseline	24	5.916	1.1764	2.77	6.333	1.2740	3.00
Assessment at 4th Week	24	5.291	1.2676	2.00	4.625	.7109	1.96
Assessment at 8thWeek	24	4.583	.9743	1.23	2.625	1.1726	1.04
X^2		34.225			47.064		
P value		<.001			<.001		
	Paired Difference						
		Test Statistic	**S.E**	**P value**	**Test Statistic**	**S.E**	**P value**
Baseline to 4th week		0.771	.289	.008	1.042	.289	.001
4th Week to 8th week		0.771	.289	.008	.917	.289	.001
Baseline to 8th week		1.542	.289	<.001	1.958	.289	.001

The Friedman test results showed within-group differences for the visual analogue scale at baseline, at the 4th week, and the 8th week post-intervention, indicating a significant improvement in both groups, with a P value of <.001. Chi square value in SLR group (34.225) and SLUMP group (37.064).

Discussions

In an RCT conducted by Cleland, Childs, Palmer, and Eberhart (2006), it was concluded that stretching can help patients with non-radicular low back pain (LBP). In this subset of patients, slump stretching, combined with lumbar spine mobilization and exercise, was beneficial in reducing short-term impairment, alleviating pain, and promoting centralization of symptoms. All patients were treated with physical therapy twice weekly for 3 weeks for a total of 6 visits, with a p-value between the groups (p=>.05). The results of this study support our findings, which show that slump stretching produces significant improvements in back pain and reduces disability, with a p-value of less than .001.

In another study by Halbertsma, Göeken, Hof, Grootoff, and Eisma (2001), on extensibility and stiffness of the hamstrings in patients with nonspecific low back pain it was concluded that patients with nonspecific LBP have limited range of motion (ROM) and reduced hamstring extensibility, which was not due to increased hamstring muscle stiffness but rather to the patients' tolerance for stretching. There was no correlation between increasing muscle stiffness and the restricted extensibility (Halbertsma et al., 2001).

The current study aligns with the findings that decreased hamstring tightness improves low back pain and range of motion (ROM). There were more documents on the Straight leg raise technique. In a study by Hall et al. (2006), the immediate effects of the Mulligan Traction Straight Leg raise technique (TSLR) on range of straight leg raise (SLR) in subjects with low back pain (LBP). Concluded that SLR's range increased significantly (F = 34.28, p 0.001). When a restriction of SLR is present, these findings offer preliminary support for the use of the Mulligan TSLR approach in the treatment of LBP. In the current study, the Mulligan SLR technique improved the range of motion (ROM) of hip flexion during 8 weeks of sessions, with an F value of 210.579, and showed a significant p-value (<.001).

In study of Čolaković and Avdić (2013) on effects of neural mobilization on pain, straight leg raise test and disability in patients with radicular low back pain it was concluded that patients who had neural mobilization and underwent lumbar stabilization had higher VAS ratings and Straight Leg Test scores than those who underwent active range of motion exercises and lumbar stabilization. These findings highlight the importance of targeted physical intervention in managing spinal pain. Similarly, when addressing chronic neck pain and postural issues, a comprehensive strategy that goes beyond medication and exercise therapy, such as a biopsychosocial model and strength-based exercises, may also prove beneficial (Anwar et al., 2024).

A study conducted by Nagrale, Patil, Gandhi, and Learman (2012), determined the effects of slump stretching versus lumbar mobilization with exercise in patients with non-radicular low back pain. The goal of this study was to determine whether slump stretching improves pain, disability, and fear-avoidant attitudes in individuals with NRLBP and brain mechanosensitivity. The findings of this study supported the use of slump stretching in conjunction with spinal mobilization and stabilization exercises in the treatment of Non-radicular low back pain. There were large within-group changes for all outcomes with $P<0{\cdot}01$. In the current study, slump stretching showed a significant p value (<.001) proving to be more effective regarding low back pain (Nagrale et al., 2012).

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