Research Paper

Effect of Slump Stretching and Straight Leg Raising Techniques for Lumbosacral Radiculopathy: A Comparative Study

Sidra Firdous Iqbal[1], Naveed Anwar[1], Arooj Fatima[2], Ghulam Saqulain[3*]

1. Department of Physical Therapy, Faculty of Allied Health Sciences, Riphah International University, Islamabad, Pakistan.
2. Department of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Lahore, Pakistan.
3. Department of Otorhinolaryngology, Capital Hospital Islamabad, Islamabad, Pakistan.

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Citation Iqbal SF, Anwar N, Fatima A, Saqulain Gh. Effect of Slump Stretching and Straight Leg Raising Techniques for Lumbosacral Radiculopathy: A Comparative Study. Iranian Rehabilitation Journal. 2024; 22(1):55-62. http://dx.doi.org/10.32598/irj.22.1.1335.14

http://dx.doi.org/10.32598/irj.22.1.1335.14

Article info:
Received: 05 Nov 2022
Accepted: 11 Oct 2023
Available Online: 01 Mar 2024

Keywords:
Lumbar, Radiculopathy, Straight leg raise, Slump stretching

ABSTRACT

Objectives: This study aimed to determine the impact of slump stretching and straight leg raising (SLR) therapy on pain, disability, and range of motion for cases suffering from lumbosacral radiculopathy.

Methods: The current randomized trial was conducted from July 2021 to March 2022 in Kanaan Physical Therapy Clinic, Lahore City, Pakistan. Utilizing consecutive samples, a sample of twenty-six patients was selected aged 30 to 50 years with symptomatic radiculopathy or provocation on the SLR test at an angle of 45-70 degrees. Patients were randomly allocated to either the slump stretching group or the SLR group through a lottery method. The outcome measuring tools were a numeric pain rating scale (NPRS) for pain, modified Oswestry disability index (MODI) for disability, and a goniometer for measuring SLR. Each patient received designated treatment with a frequency of 4 days a week over 4 weeks. Data analysis was conducted using SPSS software, version 21.

Results: The between-group analysis shows that the slump stretching group showed a significant difference (P<0.001) in terms of NPRS with a mean of 3.00±0.74, MODI (25.42±8.45), and SLR (66.33±8.44) as compared to SLR group which exhibited results of NPRS with a mean of 6.33±1.07, MODI (37.86±4.06) and SLR (55.66±4.62). Within-group statistics also revealed a significant betterment for groups (P<0.001).

Discussion: The study concludes that slump stretching therapy has higher effectiveness than the straight leg raising technique (SLRT) in reducing pain and functional disability and enhancing the range of SLR in patients with lumbosacral radiculopathy.

*** Corresponding Author:**
Ghulam Saqulain, Professor.
Address: *Department of Otorhinolaryngology, Capital Hospital Islamabad, Islamabad, Pakistan.*
Tel: *+98 (33) 35101134*
E-mail: *ghulam_saqulain@yahoo.com*

Highlights

- Slump stretching resulted in significantly lower (3.00±0.74) numeric pain rating scale (NPRS) compared to straight leg raising (SLR) (6.33±1.07).

- Slump stretching resulted in significantly better and lower (25.42±8.45) modified Oswestry disability index (MODI) compared to SLR (37.86±4.06)

- A significantly higher SLR (66.33±8.44) was present in the slump stretching group compared to the SLR group (55.66±4.62).

Plain Language Summary

Lumbosacral radiculopathy is an important cause of lower back pain with a high incidence. A low to moderate level of evidence exists in favor of the slump stretching technique (SST) to positively affect lower back pain. Hence, the current study was designed to determine the impact of slump stretching and straight leg raising (SLR) therapy on pain, disability, and range of motion for cases suffering from lumbosacral radiculopathy. The current trial involving 26 cases of lumbosacral radiculopathy indicated a significant difference (P<0.001) for the slump stretching group in terms of NPRS with a mean score of 3.00±0.74, modified Oswestry disability index (MODI) (25.42±8.45), and SLR (66.33±8.44) as compared to SLR group which exhibited results of NPRS with a mean of 6.33±1.07, MODI (37.86±4.06), and SLR (55.66±4.62). Within-group statistics also revealed significant betterment for both groups (P<0.001) indicating that the SST was more effective.

Introduction

Low back pain (LBP) predominantly affects the musculoskeletal system causing disability. Lumbosacral radiculopathy is an important cause of LBP and is considered a syndrome with pain resulting from compression/irritation of nerve roots with radiation of pain to one or both lower extremities with the degree of spinal involvement specifying affected dermatome [1]. Radiculopathy involving the lumbar and sacral region is the compression involving the dorsal lumbar as well as sacral nerve roots. This leads to excruciating pain, numbness, and weak extremities. A sensation of tingling, numbness, and paresthesia may also be present [2]. The nerve roots exit the thecal sac in the lateral recess, hence, compression can occur in the thecal sac. This may result from problems like disc prolapse, bulge or hernia, hypertrophy of facet or ligament, spondylolisthesis, infection, and tumors [3].

With a lifetime prevalence of 60-85% for LBP [2], lumbar radiculopathy has an incidence of 4.86/100 persons-years [4] and an estimated prevalence of 3 to 5%, affecting men in their fourth and females in their fifth or sixth decade [3]. A literature gap exists as regards chronic LBP prevalence in developing nations. An Indian study reveals a prevalence of 23% for LBP with 30% having radicular pain [5]. The severity of radiculopathy may vary from mild with sensory changes, pain, and no motor loss; moderate with sensory changes or pain with mild loss of motor function; and severe when sensory symptoms and pain occur with marked motor loss which results in disability [6].

A variety of treatment options are available to treat lumbar radiculopathy and LBP. These include spinal surgery and medicines commonly used to control symptoms of pain with anti-inflammatories including both non-steroidal and steroidal with limited evidence in support. In addition, lumbar traction, and manual therapy are done by physiotherapists and chiropractors [1].

A variety of treatment methods are in use to treat LBP caused by lumbar radiculopathy by therapists including stretching and strengthening, interferential therapy, and manual or mechanical traction methods [7]. Literature reveals that manual therapy is quite effective in treating muscular diseases in cases with lumbar radiculopathy. Other physiotherapy recommendations include stimulation, electrotherapy, traction, taping, and exercises [8]. Improvement in cases with non-radicular LBP has also been reported, thus reducing the symptoms of short-term disability, pain, as well as symptom centralization [9]. Inadequate evidence is present to support the efficiency of slump stretching exercises in cases of patients presenting with LBP.

The straight leg raise (SLR) and slump tests are among the most common physical examination tests that are used for the assessment of LBP with the slump stretching technique (SST) being more sensitive than the SLR test [10]. However, findings contrary to this have been reported in another study [11]. Thus, previous literature holds contradictory views regarding the more accurate test of the two.

Since neurogenic LBP involves the distribution of the sciatic nerve, which is abnormally stimulated resulting in activation of signals [12]. This may be due to the sensitivity of the growing neural tissue suggesting the variability of neuro-dynamics. Ramos et al. in a study reported that the treatment with neural mobilization reduces the intensity of LBP and increases the lumbar mobility [13]. This can accelerate the process of recovery of the functional capacity and accelerate patients' activities to normal daily life [14].

Slump stretching is a neuro-dynamic treatment and literature reveals low moderate levels of evidence in favor of the SST positively affecting pain in LBP cases [15]. Hence, the current study was designed to determine the impact of slump stretching and SLR therapy on pain, disability, and range of motion for cases suffering from lumbosacral radiculopathy. This study is important since it will better inform therapists regarding the two treatment modalities that were found effective in the literature.

Materials and Methods

The current randomized clinical trial recruited a sample of 26 cases with lumbosacral radiculopathy from Kanaan Physiotherapy Clinic, Lahore City, Pakistan. The sample included both genders, aged 30 to 50 years, having symptomatic lumbosacral radiculopathy or symptoms of provocation on SLR test at an angle of 45-70°, suffering pain sensation of mild or moderate degree ranging from 0-10 on numeric pain rating scale (NPRS), and pre-intervention modified Oswestry disability index (MODI) >10% [16]. Cases excluded included those presenting with red flags including sepsis, osteoporotic bones, fractures of the spine, previous surgery of the spine, pregnancy, cases incapable of holding an advisory position, recurring symptoms when the neck is flexed during the test, and those with SLR <45°. Also, cases suffering from lumbar spinal issues like stenosis, spondylolisthesis, spondylolysis, deformities, polyneuropathies of different etiology, ankylosing spondylitis, and those with systemic causes of LBP were excluded.

The study was conducted over a period of 9 months between 1 July 2021 to 31 March 2022. The sample size was calculated utilizing OpenEpi with a 5 % margin of error and 0.80 power of study [17]. A sample size of 26 was calculated assuming a 10% attrition rate.

Following the collection of basic demographic data including name, age, gender, height, weight, and body mass index (BMI), a thorough case history, full physical examination, and lumbar radiculopathy regional assessment was carried out by the main researcher, considering the selection criteria.

Tools used for data collection included a numeric rating scale (NPRS) to measure pain intensity, the MODI to determine how the back pain impacted patients to conduct daily life, and goniometer was used as an instrument to measure the available range of motion at the hip joint in active SLR.

Patients were equally divided into group A (SST) and group B (straight leg raising technique [SLRT]) using a lottery method. NPRS, MODI, and SLR range were noted both pre-intervention and post-intervention.

Group A (SST)

Slump stretching was conducted with the subject positioned sitting with feet on the wall. Overpressure was applied to flex the cervical spine and extend the knee to the extent that symptoms recurred. This position was maintained over 30 seconds with 3 to 5 times stretching in every session. Common treatment was also added with tibial nerve electrical stimulation applied for 10 mins in 4 sessions of exercises (lumber stabilization) for 4 days a week over 4 weeks. The complete treatment protocol extended for 16 sessions including 4 days a week for 4 weeks. The total length of each session was 25 to 30 mins [15].

Group B (SLRT)

In this technique, the subject was lying relaxed in a supine position with one pillow under the head. The affected limb was raised perpendicular to the surface in a standard SLR test until pain was felt in the back or until movement was restricted. The leg was brought a few degrees down and a series of gentle oscillations toward ankle dorsiflexion was instituted which mobilized the sciatic nerve. Gradually, the range was increased up to the maximum range of SLR until the symptom-free range was achieved. This position was held for about 30 seconds and 3 to 5 repetitions of stretches in every session of the patient. Common treatment was also added similar to that given for the slump treatment group [18].

Statistical analysis

The data analysis was done using SPSS software, version 21. With no significant difference between the groups, parametric tests were utilized including an independent sample t-test to measure differences between study groups, while a paired sample test was utilized for measuring within-group changes and P<0.05 was taken as significant.

Results

In the current research, twenty-six cases were physically screened between 1 July 2021 to 31 March 2022. Two patients withdrew from the study and 24 cases were randomized into the SST group (n=12) and SLRT group (n=12) group. This study revealed no significant difference between the SST group and SLRT group (P=0.829) with a mean age of 41.83±5.48 years and 42.08±5.28 years, respectively. No significant difference was noted for height (P=0.117), weight (P=0.206), and BMI (P=0.540) for both groups. The normality of data was determined utilizing the Shapiro-Wilk test. P>0.05 indicated that data was normally distributed, hence parametric tests were utilized for data analysis (Table 1).

Between-group analysis (Table 2) revealed no significant difference before treatment between mean scores for SST and SLRT for NPRS (P=0.857), MODI (P=0.841), and SLR range (P=0.391). However, after receiving treatment, the mean scores for SST and SLRT revealed a significant difference for NPRS (P=0.000) with higher means for SLRT indicating more pain relief in SST, MODI (P=0.000) with higher scores for SLRT indicating SST showing greater improvement in disability, and SLR range (P=0.001) with higher scores for SST indicating increased range of motion.

Table 1. Independent sample t-test for patients' characteristics in both groups (n=24)

Demographic Characteristic	Mean±SD		T	P
	SST	SLRT		
Age (y)	42.08±5.282	41.58±5.9	0.219	0.829
Height (m)	1.68±0.13	1.76±0.12	-1.632	0.117
Weight (kg)	74.58±20.61	85.42±20.09	-1.304	0.206
BMI (kg/m²)	26.06±4.81	27.31±5.06	-0.623	0.540

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Abbreviation: BMI: Body mass index; SST: Slump stretching technique; SLRT: Straight leg raising technique.

Table 2. Between-group analysis with mean scores of both treatment groups (n=24)

Test	Timing Concerning Intervention	Mean±SD		T	P
		SST	SLRT		
NPRS	Pre	7.67±1.07	7.58±1.16	0.182	0.857
	Post	3.00±0.74	6.33±1.07	-8.860	0.000
MODI index	Pre	43.34±5.59	43.76±4.41	-0.203	0.841
	Post	25.43±8.45	37.87±4.06	-4.590	0.000
SLR range	Pre	51.08±5.74	49.17±4.95	0.876	0.391
	Post	66.33±8.44	55.67±4.62	3.840	0.001

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Abbreviation: MODI: Modified Oswestry disability index; SST: Slump stretching technique; SLRT: Straight leg raising technique; NPRS: Numeric pain rating scale.

Table 3. Within-group analysis of NPRS, MODI, SLR range across slump stretching exercise group, and SLR exercise group (n=24)

Scale/Test	Group	Mean±SD		T	P
		Pre-treatment	Post-treatment		
NPRS	SST	7.67±1.07	3.00±0.74	16.42	0.000
	SLRT	7.58±1.16	6.33±1.07	5.74	0.000
MODI	SST	43.34±5.59	25.43±8.45	10.60	0.000
	SLRT	43.76±4.41	37.87±4.06	17.28	0.000
SLR range	SST	51.08±5.74	66.33±8.44	-8.31	0.000
	SLRT	49.17±4.95	55.67±4.62	-22.52	0.000

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Abbreviations: SST: Slump stretching technique; SLRT: Straight leg raising technique; SLR: Straight leg raising MODI: Modified Oswestry disability index; NPRS: Numeric pain rating scale.

Within-group analysis revealed a significant difference (P<0.001) in both SST and SLRT groups, however, improvement was more pronounced for the SST group for NPRS, MODI, and SLR range (Table 3).

Discussion

The literature reveals the frequent use of SST for lumbosacral radiculopathy in a variety of non-homogenous populations [19]. This study compared the effect of the SLR technique and SST in patients with lumbosacral radiculopathy.

Study results revealed significantly (P<0.001) better post-treatment NPRS scores in the SST group with mean scores of 3.00±0.74 compared to 6.33±1.07 for the SLRT group. These results are in alignment with the study of Patel et al. which also showed that SST was better in treating pain as compared to SLRT [20]. SST is also effective in treating LBP presumably by decreasing intra-neural edema resulting in reduced neural tension and hypoalgesia mediated by C fibers [21]. In addition, inhibitory effects on the sympathetic system were also linked with SST since it also impacts the stretching capability of the nerve. Another reason that might explain pain reduction is that SST also results in decreasing adherence of scar tissue to neural tissue [21]. In contrast, Ferreira et al. reported no improvement in pain as well as disability with 15 days of neuro-dynamic management [22]. Similarly, in a study, Rezk-Allah SS et al. reported no significant difference in postoperative pain reduction between SST compared to SLRT in cases with herniation of lumbar disc [23]. These results contrast with the current study which revealed significantly better results for SST compared to the SLRT group through both revealed improvements. The SLRT group showed significant results in improving range following a previous study by Neal Hanney et al. who investigated the SLRT effects on hip flexion and found improvement in the range [24]. Similarly, SST also revealed significantly improved function compared to SLRT in a previous study involving lumbosacral radiculopathy [20]. However, the range of movement (ROM) results shown by SLRT were significantly better (P=0.001). Hence, SST was more effective for increasing the range with a mean score of 66.33±8.44 for the SST group compared to 55.66±4.61 for the SLRT group which complies with the results of the study by Mishra et al. [25]. A study by Adel revealed a significant reduction in pain, ROM, and nerve root compression post-neural mobilization compared to pre-mobilization due to neuro-dynamic stretch [26], which might explain this improvement in the range found in the current study. However, elastic deformation may also be the reason for this change [24]. The flexibility of the posterior myofascial chain is also affected by slump mobilization which causes an increase in the angle at the tibiotarsal joint and also increases finger-floor length. This can also act as a factor responsible for improving SLR values [27].

The current study used the MODI to measure the change in disability after applying treatment measures. Data analysis shows a significant (P<0.001) reduction in MODI in slump stretching pre-treatment from 43.34±5.59 to post-treatment 25.43±8.45 and SLR group pre-treatment (43.76±4.41) to post-treatment (37.87±4.06) indicating better results in slump group with more decrease in index score as compared to SLR group. These results are in agreement with a previous study which also compared these techniques in lumbar radiculopathy and showed similar results to the current study and proved SLRT less effective compared to SST [20]. Another study that investigated the effects of neuro-dynamic mobilization on radiculopathy of the lumbosacral region revealed that neuro-dynamic treatment along with conventional treatment enhanced the improvement in disability [2]. These results are in agreement with the current study in which both groups showed a significant decrease in MODI scores with P<0.001. This is also in agreement with the study by Bertolini et al. which reveals that demyelination is affected by pressure perceived by the nerve due to compression of micro-circulation, and these neuro-dynamic techniques help disperse the edema, thus causing a reduction in associated symptoms [28]. Additionally, neural mobilization can help reduce tension and friction resulting in a reduction of mechanosensitivity [29]. Therefore, a neuro-dynamic method is a superior form of management when given in radiculopathy as it decreases pain and might be the reason for improved function in back pain due to radicular problems in the lumbosacral area. In contrast to the current study, Ferriera et al. reported that the score of disability index did not show any significant improvement in disability when analyzed at the interval of two weeks [22].

The results of this study suggested that the combined effect of the treatment program of lumbar stabilization and neural mobilization are very significant in LBP of radicular origin as shown by Gupta in his study. He found that Nerve mobilization techniques are effective in enhancing patient outcomes when applied in addition to standard care in managing sciatica [30]. Hence, this study proved that the SST group is more effective in improving pain, disability, and ROM.

Conclusion

This study concludes that however both slump stretching and SLRT result in improvement, the SST is significantly more effective than the SLRT in reducing pain, functional disability, and enhancing the range of SLR in cases suffering from lumbosacral radiculopathy.

Ethical Considerations

Compliance with ethical guidelines

This research approved by the Ethical Committee of Riphah International University (Code:# REC/RCR & AHS/21/0134). Written consent was obtained from all participants for inclusion in the study.

Funding

This article extracted from master's thesis of Sidra Firdous Iqbal, approved by Riphah International University.

Authors' contributions

Conceptualization: Arooj Fatima and Naveed Anwar; Methodology, resources and data curation: Sidra Firdous and Arooj Fatima; Formal analysis and writing the original draft: Naveed Anwar and Ghulam Saqulain; Review and editing: Ghulam Saqulain and Sidra Firdous; Supervision: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors are indebted to administration of Kanaan Physiotherapy Clinic for making this study possible.

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