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Effect of positioning of the contralateral lower limb on neurodynamics of straight leg raise test in subjects with low back pain

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Abstract

Introduction: A neurodynamic test (SLR) is deemed positive with the reproduction of symptoms and/or the presence of antagonistic muscle activity to prevent further nerve bed elongation in low back pain patients. This study identify the neurodynamic changes associated with contralateral limb positioning in patients with low back pain. Objective of this study is to quantify ranges of straight leg raise test with different positioning of the contralateral lower limb in subjects with LowbackPain and to establish which contralateral limb position produces maximum neural tension in ipsilateral straight leg raise test in subjects with LowbackPain[11].

Materials and Methods: Sixty patients with Low Back Pain, ranging from 25-45 years of age, with positive SLRT (30^0-70^0) were randomly, assessed with Straight Leg Raise test (Basic) with the contralateral lower limb in neutral (Group A), the same test was then carried out with the contralateral lower limb in flexed positions(Group B) and the abduction positioning of the contralateral leg was carried out with 30^0 passive abduction of the hip joint with the knee and foot in neutral position and were evaluated by measuring ROM with the help of Goniometry. Data analysis was performed using SPSS 16**.**

Results: This suggests that there were significant difference in three different positioning of contralateral leg on Sciatic nerve sensitivity.

Conclusion: neural mobilization treatment protocol with appropriate positioning of the contralateral extremity for early and effective recovery from LBP.

Keywords: low back pain, neural mobilization, straight leg raising test

Introduction

Low Back Pain (LBP) is one of the most common reasons for seeking help from physiotherapists. It costs billions of dollars per year and immeasurable suffering, so much so that the physiotherapists are treating thisproblem on a daily basis[1]. Because of its frequency and its benign character, back pain is often seen as a trivial problem compared to other afflictions that generate a high mortality, like cancer or infectious diseases [1].

The incidence of low back pain (LBP) has been estimated between 40%-56% of the general population per year [2]. Between 60% and 80% of the population will experience LBP during their lives [3] and up to 15% of the incidence of back pain become chronic [4]. LBP is the most frequent cause of disability in individuals who are less than 45 years and the third leading cause in those 45 years and older [5].

The frequency of severe back pain increases with increasing age [6]. Evidences suggest that there is an age-related increase in the prevalence of pain and other symptoms and conditions which interfere with life and restrict social and physical functioning. Non-specific or common low back pain is defined as pain between the costal margins and the inferior gluteal folds, usually accompanied by painful limitation of movement, often influenced by physical activities and posture, and which may be associated with referred pain in the leg [7].

Many factors increase the risk of development of low back pain. Poor posture, such as slouching in a chair, driving hunched over, standing incorrectly, and using poor body mechanics when lifting and carrying heavy loads are risk factors. Sleeping on a soft or sagging mattress, Jobs that require long hours of standing without a break, Sports that involve twisting the back, like golf, are some of these important risk factors and mechanical causes of low back pain. As the severity increases, the pain can radiate from low back through the buttock to one or both legs and this is defined as Sciatica [7].

A neural provocation test is a sequence of movements designed to assess the mechanicsand physiology of that part of the nervous system by elongationof the nerve [13]. The test done for provocation of symptoms for sciatic nerve is passive straight leg raise (SLR).

The straight leg raise (SLR) test has biomechanical effects on pelvis movement, on lumbosacral neural structures [8] and hamstring muscles [9]. Hence, it is important to evaluate the component movements that include hip flexion and posterior pelvic rotation [10] when investigating the straight leg raise (SLR) test.

A neurodynamic test (SLR) is deemed positive with the reproduction of symptoms and/or the presence of antagonistic muscle activity to prevent further nerve bed elongation. The passive straight leg raise (SLR) procedure is routinely used in the assessment of patients with lumbar pain [10].

In a normal person, the SLR pulls the neuraxis caudally, stretching the lumbar intervertebral roots in the lumbosacral foramen all the way to the cervical nerve roots. Each joint position and passive positioning by the therapist may and often needs to be adaptable to various situations (previous injuries, decreased range of motion). In the same respect, altering joint position may be used as a means to sensitize the system and lead to a possible differential diagnosis. Thus this study is aimed to expand the work done by the studies conducted abroad to identify the neurodynamic changes associated with contralateral limb positioning in patients with low back pain in India and an effort to ensure best professional practice based on research evidence from scientific literature. Objective of this study is to quantify ranges of straight leg raise test with different positioning of the contralateral lower limb in subjects with LowbackPain and to establish which contralateral limb position produces maximum neural tension in ipsilateral straight leg raise test in subjects with Lowback Pain [11].

Materials and Methods

Study Design: Experimental study design. Informed consent was taken from all the participants included in the study. All the participants who met the inclusion criteria were evaluated thoroughly using screening Performa.

Population and Sampling

Sampling: Convenient Sampling
Age: The patients were in the age group of 25-45 years.
Sex: Out of sixty patients, 26 were males and 34 females.
Side: In 30 cases, the patient's right side was affected, and in 30, the left side was affected.

Source of Data

Sarvodya hospoital, Faridabad, SGT Hospital, Physiotherapy OPD Gurugram, Haryana.

Instruments and tools for data collection

Universal Goniometer: Traction Stool, Sand Bags/ Medicine Ball

Inclusive Criteria & Exclusive Criteria

Participants with low back pain were selected and were included in the study after meeting the following inclusion criteria: Low Back Pain with or without lower limb radiculopathy, SLR Basic positive (30-70^0)**,** Minimum duration of symptoms was 6 months, Having the age group 25 to 45 years. Alert and able to follow commands.

Subjects with following conditions were excluded from the study with Previous History of fractures and trauma to vertebral column and Lower Limbs, Any history of hip and knee pathology or related orthopaedic conditions like scoliosis, disabling arthritis, Pregnancy, Prediagnosed cases of PIVD, Fibrositis and SI strain, Comorbid conditions such as amputation, tumors, severe cardiovascular diseases(unstable angina, latest myocardial infarction and malignant hypertension), respiratory diseases(acute asthma and exacerbated states), and degenerative neurological diseases(Stroke, Parkinson's disease, Diabetic peripheral neuropathy and other systemic disease processes like SLE etc)., Recent surgical history like abdominal, lower limb or any related surgeries, Patients with uncompensated limb length discrepancy

Procedure for data collection

Sixty patients with Low Back Pain, ranging from 25-45 years of age, were included in the study. Their demographic profile and detailed medical history were collected through individual interviewing and from medical records.

An informed consent was signed by Patients while being enrolled in the study.

All of the available LBP patients with positive SLRT (30^0-70^0) were examined and detailed medical history were collected through individual interviewing and from medical records.

Anthropometric measurements (height, weight) were taken and BMI calculated for all the subjects to ensure matching of subjects.

Group A: Each subject was assessed with Straight Leg Raise test (Basic) with the contralateral lower limb in neutral and the range of motion was recorded with universal goniometer at the moment where symptoms began to appear. Positive symptoms included pain originating from the low back region extending down the posterior thigh or leg.

Group B: The same test was then carried out with the contralateral lower limb in flexed positions

The flexion positioning of the contralateral leg was carried out with passive hip flexion with knee extension and foot in neutral. The patient's leg was placed on a fixed surface (traction stool) with the hip flexion kept at 30^0.

Group C: The abduction positioning of the contralateral leg was carried out with 30^0 passive abduction of the hip joint with the knee and foot in neutral position in supine. A weighted object like sand bag or medicine ball (as per the availability) was kept on either side of the foot to prevent any rotation or displacement from the desired position.

Data Analysis

The range of motion at hip joint at the moment where SLR test was positive (i.e. pain in low back or leg) was measured for quantitative analysis. The data was analyzed using SIGMA STAT Software. The results were expressed as Mean + S.D. and the level of significance was set at 5% (= 0.05).

One-Way Analysis of Variance test (ANOVA) was used to analyze the variation between different conditions in all subjects and the relationship of different positioning of contralateral lower limb with neurodynamic test for Sciatic nerve in a single group containing 60 subjects.

Post hoc analyses were done using Dunnett's Test to find the most sensitizing position among the flexion and abduction of contralateral leg as compared to the neutral positioning.

Result

One- Way ANOVA has been used to compare the angles where the Straight Leg Raise Test was positive when the contralateral leg was placed in neutral, flexion, and abduction positions among themselves.

It was found that the results are significant with an F value of 18.685 and a probability value of $p < 0.001$ which is highly statistically significant. This suggests that there were significant difference in three different positioning of contralateral leg on Sciatic nerve sensitivity.

Post hoc analyses were done using Dunnett's Test to perform multiple comparisons with the neutral positioning category to find out the most sensitizing position. When compared to the Abduction position, Flexion was found to be more sensitive at a $p < 0.05$ which is statistically significant.

Table 1: Demographic Data of the Patients.

Variables	Patients
Female	34
Male	26
Age Range (Mean)	25-45 (37.817)
Affected Side	
Right	30
Left	30
Duration of Affection	6 months minimum

Table 2: Distribution of Mean values and Standard Deviation of Age of all the LBP patients

Age	Mean	S.D.	Mean ± S.D.	N
	37.817	6.845	37.817±6.845	60

Table 3: Distribution of Male and Female patients with LBP (N = 60)

	Males	Females
Number of patients	26	34
Percentage	43.33%	56.66%

Table 4: Distribution of LBP patients according to the side of affection. (N = 60)

	Right	Left
Number of patients	30	30
Percentage	50%	50%

Table 5: Distribution of Mean values and Standard Deviations of Height, Weight, and BMI of all the patients included in the study. (N=60)

	Height (cm)	Weight (Kg)	BMI (Kg/m^2)
Mean	157.62	70.02	28.53
S.D.	5.45	10.002	5.16
Mean ± S.D.	157.62 ±5.45	70.02±10.002	28.53±5.16

Table 6: Distribution of Mean values, S.D. and F-value for SLR (in degrees) in three Different positions of contralateral(c/l) leg.

	SLR-Neutral	SLR with c/l Flexion	SLR with c/l Abduction
Mean	51.2	47.483	58.9
S.D.	10.72	10.697	9.865
Mean ± S.D.	51.2±10.72	47.483±10.697	58.9±9.865

F Value = 18.685, N = 60, p = <0.001

Discussion

The results of this present study reported a significant effect of the positioning of the contralateral leg on the neurodynamics of Straight Leg Raising Test in Low Back Pain Patients.

The results are in accordance with the work of Denise M Cameron[14]*et al* who studied the Influence of Hip Position on Measurements of the Straight Leg Raise Test on twenty two healthy, young subjects. They found that Hip position affected SLR relative to horizontal and pelvis relative to horizontal. They also concluded that hip position affects SLR differently depending upon whether it is performed actively or passively. A greater amount of SLR was obtained with the opposite hip extended when performed passively; however, with the opposite hip flexed, the opposite was true.

The same results are found in the present study with Passive Straight Leg Raise. The amount of SLR has been found to decrease with flexion positioning of the contralateral leg as compared to the neutral positioning of the contralateral leg.

Similarly, Warren Hammer [13] studied effect of lower limb movement on upper extremity symptoms and found that the upper limb symptoms were produced by movement of lower extremity on SLR testing and proposed that it was most probably due to altered neurodynamics of the neuraxis.

De Beurmann[14] demonstrated marked stretch of the sciatic nerve in cadavers during the performance of the Lasegue test and concluded that this factor of stretch, rather than that of a muscle contracture was the actual cause of pain.

Similarly, the symptoms appeared in positive SLRT in the present study because of stretching of the Sciatic nerve during the performance of Straight Leg Raise Test as supported from the study by De Beurmann.

The findings of the present study also reveal that the Flexion positioning of the contralateral leg during Straight Leg Raise Test was more sensitive.

Fajersztajn [15] reported for the first time the so-called crossed-sciatic phenomenon or the elicitation of pain in the affected hip and, limb by the performance of the straight-leg-raising test on the healthy extremity

Fajersztajn [15] conducted cadaver dissections to prove his postulate that tension on one sciatic nerve produces tension in the spinal roots of the opposite nerve. With the lumbosacral roots exposed, traction on one sciatic nerve was shown to pull the dural sac caudally and ipsilaterally, and at the same time to displace the contralateral roots in a centrifugal fashion.

The above findings support the results of the present study that flexion positioning of the contralateral extremity sensitizes the Sciatic nerve to a greater extent as compared to the neutral positioning.

Flexion of one hip only, keeping the knee on this side extended, produced a similar increase of tension in the roots of the corresponding side, and the anterior portion of the dural theca was displaced slightly towards the side of the flexed limb by the movement. Such a movement of the theca towards the flexed limb will produce some increase in tension in the extradural roots of the opposite side, this increase being much less, however, than would result from flexion of the opposite limb itself.

Thus, with Flexion of the contralateral lower limb, increased tension in the ipsilateral extradural roots could have been the cause for early production of symptoms while performing the Sciatic Nerve Neurodynamictest. Further, it was noted that when the extradural roots of one side had been rendered tense by flexing the hip with the knee extended, the tension could be

immediately relaxed by flexion of the knee on this side. Finally, it was noticed that flexion of the neck produced an upward movement of both spinal cord and dura within the spinal canal, and, of course, herefore, increased the degree of tension in the nerve-roots coursing downwards from the spinal cord.

Clinically, it is important to realize from this study that if the opposite hip is flexed during the SLR test, it will decrease the amount of SLR to horizontal and that the abduction positioning of the contralateral leg, will increase the amount of SLR to horizontal.

Conclusion

Thus, the present study holds clinical significance in devising a neural mobilization treatment protocol with appropriate positioning of the contralateral extremity for early and effective recovery from LBP.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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