

Effect of Integrated Exercise Protocol in Lumbar Spinal Stenosis as Compare with Conventional Physiotherapy- A Randomized Control Trial

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Abstract

Background context: Lumbar Spinal Stenosis (LSS) is one of the most common spinal pathologies in India. Spinal stenosis is narrowing of the spinal canal with encroachment on the neural structures by surrounding bone and soft tissue. While it is widely held that conservative management should be the first line of approach in patients with LSS, little is known about the efficacy of non-surgical treatments for this condition.

Purpose: To compare the specific integrated exercise program with conventional physical therapy programs for patients with LSS.

Study design: Experimental study.

Method: 30 patients (experimental group, n=15; control group, n=15) with lumbar spinal stenosis were randomized to one of two 3 week physical therapy programs. One program included exercise program (Flexibility exercise, Specific experimental canal enlargement exercise, strengthening exercise, functional/recreational activities), while the other included electrotherapy and exercise program (Hot fomentation, IFT, Flexion Exercises).

Outcome measures: Perceived recovery was assessed with an Oswestry Disability Questionnaire (ODQ). Secondary outcomes included: Numeric Pain Rating Scale (NPRS), Straight Leg Raise, Slump test and Modified Schober Test (MST).

Results: Result shows that the significant improvement in Quality of life, intensity of pain, lumbar ROM and Neural Flexibility was seen in Group A but it was not showing significant results in Group B. This signifies that group A has more significant improvement than Group B.

Conclusion: From the result analysis we found that the integrated exercise approach has a significant effect than a conventional physiotherapy treatment.

Keywords: Lumbar spinal stenosis (LSS); Integrated exercises; Oswestry disability questionnaire (ODQ); Numeric pain rating scale (NPRS); Modified schober test (MST)

Introduction

Approximately 60% people of India have been suffering from low back pain. It is of two types: specific or non-specific [1]. Lumbar Spinal Stenosis (LSS) is recognized in about 20% of patients of LBP while it is attributed to lumbar disk herniation in 80% of cases [2].

The term spinal stenosis is defined as 'narrowing of the spinal canal with encroachment on the neural structures by surrounding bone and soft tissue' [3]. The effect of spinal canal stenosis becomes important only when it causes interference with the ache, leg pain etc. [4]. LSS can impact a person's quality of life, affect psychosocial wellbeing and significant cause of disability [5]. Spinal canal narrowing can be occur due to degenerative changes of spine which typically involved facet joint hypertrophy, ligamentum flavum thickening, degenerative spondylolisthesis and disc bulging etc. [6]. The signs and symptoms of LSS includes pain, paresthesias, numbness and weakness in the back and legs which occur due to entrapment of the lumbosacral nerve roots in the constricted neural canal and foramina [7].

Neurogenic claudication (NC) is one of the hallmarks of LSS which is described as the classic clinical presentation of progressive onset of radicular pain, paresthesias, numbness, weakness. LSS is classified; according to anatomically and on the basis of its etiology [8,9]. Anatomically it is of two types central and lateral; **Central stenosis** can be caused by posterior disc bulging, thickening of the ligaments, osteophytic outgrowth of the facet joints, degenerative spondylolisthesis and retrolisthesis. **Lateral stenosis** can be caused by lateral disc bulging, asymmetrical loss of disc height, osteophytic overgrowth of the pedicles and superior lumbar facets.

On the basis of etiology it maybe; **Primary stenosis** involves narrowing caused by congenital malformations, defects in postnatal development and **secondary stenosis**, the spinal canal is developmentally normal, but becomes narrowed because of an acquired conditions like degenerative changes, spondylolisthesis, postsurgical scarring, lumbar intervertebral disc herniation, or combinations of these conditions [10]. Another two main is developmental and degenerative [4].

The diagnosis of LSS is based on the clinical history and findings on physical examination and imaging is often necessary in patients with LSS to determine the exact level and the severity of the stenosis [6,11]. MRI or CT scan is widely used diagnostic tools which confirm the presence of spinal stenosis [12]. The Radiological criteria for lumbar spinal stenosis (L1 to L5) according to location of the stenosis through MRI [13].

1. Central canal stenosis: Anterior – posterior diameter of spinal canal \leq 12 mm.
2. Lateral recess stenosis: lateral recess height \leq 3 mm or lateral recess depth \leq 5 mm.

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3. Foraminal stenosis: Foraminal diameter ≤ 5 mm [10].

A variety of conservative and non-conservative treatments are used for the treatment of LSS. In some cases surgical techniques are preferred to treat patients with LSS in which persistent symptoms are not adequately controlled by conservative/therapeutic modalities [14]. The Conservative management includes NSAIDS and exercise programs to strengthen musculature surrounding the low back region [15]. Physical therapy is accepted conservative [16]. There are lack of evidence in support of commonly utilized conservative interventions continues to result in lack of clarity regarding what intervention should be utilized to manage patients with LSS [17]. So, there is a need to establish the optimal rehabilitation treatment strategy for lumbar stenosis patients, as the comprehensive non-operative treatment provides better results to manage the LSS which improve the health status of the patient with least side effects and problems [18].

So the aim of the present study is to find out the effect of integrated exercise protocol on LSS as compared with conventional treatment.

Materials and Method

Nature of the present study is a Randomized Control Trial (RCT). The method of sampling was random sampling. 30 subjects between the age group of 25-50 years diagnosed as a Lumbar Spinal Stenosis through MRI Findings (AP diameter ≤ 12 mm) were included in the study. We determined the total random sample of $n=30$ [Group A, (experimental group) $n=15$ and Group B (control group) $n=15$] considering the following inclusion criteria

1. Age group 25-50 years.
2. Patient with Low back pain with or without leg pain.
3. Diagnosed case from an Expert and confirmed by medical history review.
4. MRI: lumbar spinal stenosis antero-postero diameter ≤ 12 mm

Patients meeting any of the following criteria were excluded:

1. Patient with Spinal surgery.
2. Patient with Cognitive alteration.
3. Non-cooperative patient.
4. Any concurrent major disease such as cancer, diabetes, renal failure, tumor.
5. Pregnancy

Before the commencement of the study, each subject included in the study was given information about the study and after attaining their interest, a written consent was signed from every participant. The protocols and research methodology and sample collection were approved by the department and ethical committee of physiotherapy Punjabi university Patiala, Punjab. All baseline information was obtained before randomization. Patients were scheduled for 45 to 60 min physical therapy sessions over 3 weeks (5 days a week). For one group Flexibility exercise, Specific experimental canal enlargement exercise, strengthening exercise, functional or Re-recreational activities and for other group hot outcome measures (Perceived recovery was assessed with an Oswestry Disability Questionnaire (ODQ). Secondary outcomes included: Numeric Pain Rating Scale (NPRS), Straight Leg Raise (by goniometer), Slump test (by goniometer) and Modified Schober Test (MST) were recorded on 11th day of intervention and 22nd day of post intervention (Table 1).

Results

Data was analysed with appropriate statistical tool using SPSS version 20.0 for window 7 were included in the study, the majority of subjects were males 20 patients (66.7%) and only 10 patients (33.3%) were female. Mean age is 38.53 ± 8.37 . Independent t-test used to evaluate the significance of difference between mean of two quantitative variables. The cut of level of significance was set at $\alpha=0.05$ (Figures 1-6).



Figure 1: Hydro-collateral packs.

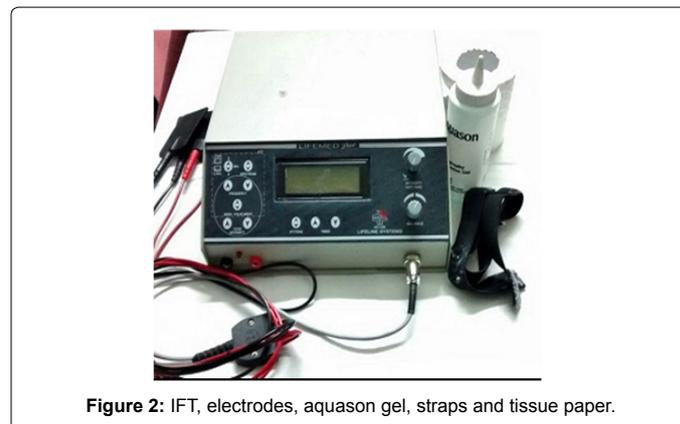


Figure 2: IFT, electrodes, aquason gel, straps and tissue paper.



Figure 3: Kneel sitting with forward bend along with arm stretch position from quadruped (canal enlargement exercise).

		STAGE I	STAGE II	STAGE III	STAGE IV	
		Flexibility Exercises	Specific Experimental Canal enlargement Ex.	Stabilization/strengthening Exercises	Functional/Regaining Activities	
Week 1	Day 1	Heel sliding in supine, spinal rotation 10 Rep each side	-no-	-no-	-no-	-no-
	Day 2	Heel sliding in supine, spinal rotation 10 Rep each side	-no-	-no-	-no-	-no-
	Day 3	Heel sliding in supine, spinal rotation 10 Rep each side	Knee to chest (single leg, double leg), 3-5 rep with 10 s hold	-no-	-no-	-no-
	Day 4	Heel sliding in supine, spinal rotation 10 Rep each side	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped (3-5 Rep. 10 s hold)	-no-	-no-	-no-
	Day 5	Heel sliding in supine, spinal rotation 10 Rep each side	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped (3-5 Rep. 10 s hold)	Pelvic bridging (3 to 5 rep with 10 s hold)	-no-	-no-
Week 2	Day 1	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility (3-5 Rep. 30 s hold)	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped (3-5 Rep. 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying (3 to 5 rep with 10 s hold)	-no-	-no-
	Day 2	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility (3-5 Rep. 30 s hold)	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped, LIONS position (5-7 Rep. 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying (3 to 5 rep with 10 s hold)	Walk inside room for 1 or 2 min increase upto 5 to 10 min as per the pain severity	-no-
	Day 3	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility (3-5 Rep. 30 s hold)	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped, LIONS position (5-7 Rep. 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying (3 to 5 rep with 10 s hold)	Walk inside room for 1 or 2 min increase upto 5 to 15 min as per the pain severity	-no-
	Day 4	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility (5-7 Rep. 30 s hold)	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped, LIONS position (5-7 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying), Sacrum counter nutation (5 to 7 rep with 10 s hold)	Walk 100-300 m (2 times/day) Start ADLs light to moderate	-no-
	Day 5	Spinal rotation(10 Rep each side), Hamstring flexibility, Piriformis flexibility (5-7 Rep. 30 s hold)	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped, LIONS position (5-7 Rep. 10 s hold).	Pelvic bridging Strengthening of gluteus medius in side lying), Sacrum counter nutation (5 to 7 rep with 10 s hold)	Walk 200-500 m (2 times/day) Start ADLs light to moderate	-no-
Week 3	Day 1	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility, IT band flexibility, Quadratus lumborum (5-7 Rep 30 s hold), Ilio psoas release	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped. Cat and camel, LIONS position (5-7 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying, Sacrum counter nutation, Posterior pelvic tilting (5 to 7 rep with 10 s hold), Abdominal prep, Quadruped arm and leg lifts (3-5 Rep 10 s hold)	Walk 200-500 m (2 times/day) Start ADLs light to moderate	Dual task activity focus on core muscle and functional activity
	Day 2	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility, IT band flexibility, Quadratus lumborum (5-7 Rep 30 s hold), Ilio psoas release	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped. Cat and camel, LIONS position. (5-7 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying, Sacrum counter nutation, Posterior pelvic tilting (5 to 7 Rep with 10 s hold), Abdominal prep, Quadruped arm and leg lifts (3-5 Rep 10 s hold)	Walk 500-700 m (2 times/day) Start ADLs light to moderate	Dual task activity focus on core and functional activity
	Day 3	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility, IT band flexibility, Quadratus lumborum (5-10 Rep 30 s hold), Ilio psoas release	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped. Cat and camel, LIONS position. (5-10 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying, Sacrum counter nutation, Posterior pelvic tilting (5 to 10 Rep with 10 s hold), Abdominal prep, Quadruped arm and leg lifts (3-5 Rep 10 s hold)	Walk 500-700 m (2 times/day) Start ADLs light to moderate	Dual task activity focus on core and functional activity
	Day 4	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility, IT band flexibility, Quadratus lumborum (5-10 Rep 30 s hold), Ilio psoas release	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped. Cat and camel, LIONS position. (5-10 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying, Sacrum counter nutation, Posterior pelvic tilting (5 to 10 Rep with 10 s hold), Abdominal prep, Quadruped arm and leg lifts (5-10 Rep 10 s hold)	Walk 1 km (2 times/day) Start ADLs light to moderate	Play badminton for 10-20 min
	Day 5	Spinal rotation (10 Rep each side), Hamstring flexibility, Piriformis flexibility, IT band flexibility, Quadratus lumborum (5-10 Rep 30 s hold), Ilio psoas release	Knee to chest (single leg, double leg), kneel sitting with forward bend along with arm stretch position from quadruped. Cat and camel, LIONS position. (5-10 Rep 10 s hold)	Pelvic bridging Strengthening of gluteus medius in side lying, Sacrum counter nutation, Posterior pelvic tilting (5 to 10 Rep with 10 s hold), Abdominal prep, Quadruped arm and leg lifts (5-10 Rep 10 s hold)	Walk 1 km (2 times/day) Start ADLs light to moderate	Play badminton for 10-20 min

NOTE:

- If pain is severing use ICE PACKS.
- Depend on the pain status the repetition may reduce or stop by physiotherapist /researcher/PI.
- All the exercises have to be done with normal breathing.
- In strengthening exercises core muscle should be engaged.
- If patient can't perform exercise, the exercises will shift to another day.

Table 1: The therapist gave the treatment protocol of 21 days (20 to 40 mins per day for five days a week for three weeks) under his observation which was described as follows.

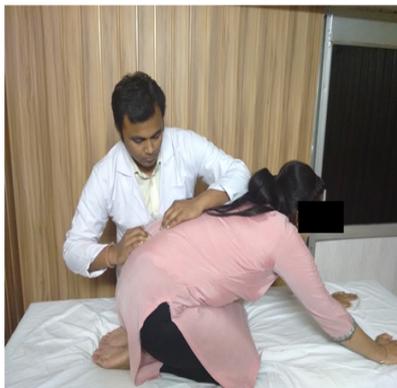


Figure 4: LIONS: Position with neck extension-starting position (for neural flexibility).



Figure 5: LIONS: Position with neck flexion-end position.



Figure 6: Strengthening of gluteus medius muscle.

Table 2 presents the improvement in QOL in ODQ measure by the two interventions used in the study. The Mean and SD on Pre intervention and post intervention at 11th and 22nd day for Group A was 61.29 ± 12.87, 42.77 ± 7.90 and 20.41 ± 4.76, respectively. In Group B, intervention and post intervention at 11th and 22nd day respectively. The mean difference between pre intervention and post intervention at 22nd day of group A and Group B was 40.87 ± 10.81 and 7.26 ± 4.56, respectively (Figure 7).

Table 3 shows the Comparison of ODQ mean value at Pre, 11th day,

22nd day and their MD (Pre – 22nd day) between Group A and Group B at 95% level of significance. The t value at pre and post intervention at 11th and 22nd day was 0.306, -2.953 and -7.343 respectively between ODQ scores of Group A and Group B. The Mean Difference for Group A Vs. Group B was 11.096 which signifies that group A has more significant improvement than Group B.

Table 4 presents the improvement in Pain in NPRS measure by the two interventions used in the study. The Mean and SD on Pre intervention and post intervention at 11th and 22nd day for Group A was 7.60 ± 0.99, 4.93 ± 0.80 and 2.13 ± 0.83, respectively. In Group B, the mean and SD value of NPRS was 6.73 ± 1.58, 6.13 ± 1.46 and 5.40 ± 1.45 at pre intervention and post intervention at 11th & 22nd day, respectively. The mean difference between pre intervention and post intervention at 22nd day of group A and Group B was 5.47 ± 0.64 and 1.33 ± 0.49 respectively. Data graphically shown in Figure 8 which is as follow:

Table 5 shows the Comparison of NPRS mean value at Pre, 11th day, 22nd day and their MD (Pre – 22nd day) between Group A and Group B at 95% level of significance. The t value at pre and post intervention at 11th and 22nd day was 1.803, -2.797 and -7.548, respectively between ODQ scores of Group A and Group B. The Mean Difference for Group A Vs. Group B was 19.892 which signifies that group A has more significant improvement than Group B.

ODQ Evaluation	GROUP A		GROUP B	
	Mean	SD	Mean	SD
Pre	61.29	12.87	59.51	18.37
11 th day	42.77	7.90	58.03	18.40
22 nd day	20.41	4.76	52.25	16.10
MD (Pre – 22 nd day)	40.87	10.81	7.26	4.56

Table 2: Mean and SD of Oswestry Disability Questionnaire (ODQ) scores at pre intervention, post-intervention at 11th day and 22nd day and their mean difference (Pre – 22nd day) of the subjects of group A and group B.

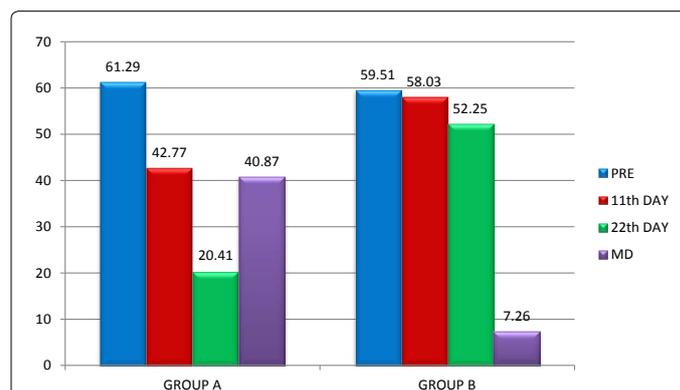


Figure 7: Shows the comparison of mean value for ODQ at pre Interval, 11th day and 22nd day between Group A and Group B.

ODQ Evaluation	GROUP A Vs. GROUP B	
	t value	
Pre	0.306	
11 th day	-2.953*	
22 nd day	-7.343*	
(Pre – 22 nd day)	11.096*	

*p<0.05=Significant

Table 3: Comparison of ODQ mean value at Pre, 11th day, 22nd day and MD (Pre – 22nd day) between group A and group B.

Table 6 shows the Comparison of MST mean value at Pre, 11th day, 22nd day and their MD (Pre – 22nd day) between Group A and Group B at 95% level of significance. The t value at pre and post intervention at 11th and 22nd day was 0.306, 2.267 and 5.367 respectively between MST scores of Group A and Group B. The Mean Difference for Group A Vs. Group B was 3.895 which signifies that group A has more significant improvement than Group B.

Table 7 shows the Comparison of SLR mean value on right and left leg respectively at Pre, 11th day, 22nd day and their MD (Pre – 22nd day) between Group A and Group B at 95% level of significance. The t value of SLR score for the right leg at pre and post intervention at 11th and 22nd day was 1.333, 2.076 and 3.758 and for the left leg 0.075, 2.343 and 4.691, respectively between SLR scores on right leg of Group A and Group B. The Mean Difference for Group A Vs. Group B for right leg was 1.581 and for left leg was 2.837, respectively, which signifies that group A has more significant improvement than Group B.

Table 8 shows the Comparison of ST mean value on right leg and left leg at Pre, 11th day, 22nd day and their MD (Pre – 22nd day) respectively between Group A and Group B at 95% level of significance. The t value of right leg at pre and post intervention at 11th & 22nd day was 1.428, -0.830 and -3.510 and for the left leg 1.414, 0.000 and -3.136 respectively where ST scores of Group A and Group B at pre and 11th day

NPIS	GROUP A		GROUP B	
	Mean	SD	Mean	SD
Pre	7.60	0.99	6.73	1.58
11 th day	4.93	0.80	6.13	1.46
22 nd day	2.13	0.83	5.40	1.45
MD (Pre – 22 nd day)	5.47	0.64	1.33	0.49

Table 4: Mean and SD of numeric pain rating scale (NPRS) at Pre, 11th day, 22nd day and MD (Pre – 22nd day) for the subjects of group A and group B.

NPRS	GROUP A vs. GROUP B	
	t value	
Pre	1.803	
11 th day	-2.797*	
22 nd day	-7.548*	
(Pre – 22 nd day)	19.892*	

*p<0.05=Significant

Table 5: Comparison of mean value for NPRS at Pre, 11th day, 22nd day and MD (Pre – 22nd day) between group A and group B.

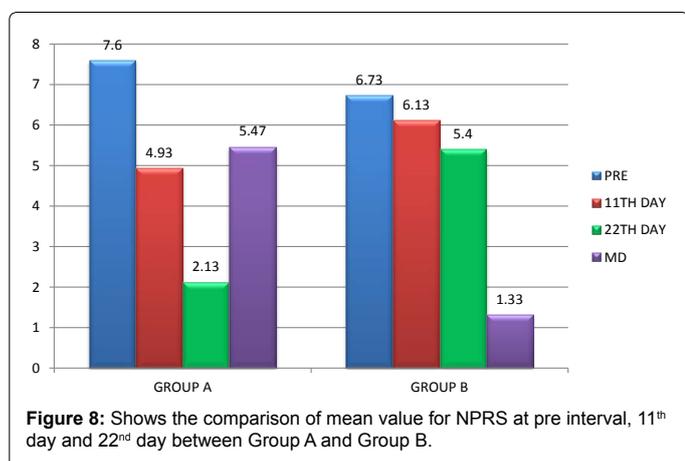


Figure 8: Shows the comparison of mean value for NPRS at pre interval, 11th day and 22nd day between Group A and Group B.

MST	GROUP A vs. GROUP B	
	t value	
Pre	0.306	
11 th day	2.267*	
22 nd day	5.367*	
(Pre – 22 nd day)	3.895*	

*p<0.05=Significant

Table 6: Comparison of mean value for modified Schober test (MST) at Pre, 11th day, 22nd day and MD (Pre – 22nd day) between group A and

SLR	GROUP A vs. GROUP B	
	t-value	
	SLR Right	SLR Left
Pre	1.333	0.075
11 th day	2.076	2.343*
22 nd day	3.758*	4.691*
(Pre – 22 nd day)	1.581*	2.837*

*p<0.05=Significant

Table 7: Comparison of mean value for straight leg raise (SLR) Right at Pre, 11th day, 22nd day and MD (Pre – 22nd day) between group A and group B.

ST	GROUP A vs. GROUP B	
	t value	
	Right Leg	Left
Pre	1.428	1.414
11 th day	-0.830	0.000
22 nd day	-3.510*	-3.136*
(Pre – 22 nd day)	6.564*	5.314*

*p<0.05=Significant

Table 8: Comparison of mean value for slump test (ST) right at Pre, 11th day, 22nd day and MD (Pre – 22nd day) between group A and group B.

show no significant improvement whereas 22nd day shows significant improvement for both right and left leg. The Mean Difference for Group A Vs. Group B for right leg was 6.564 and for the left leg was 5.314 respectively, which signifies that group A has more significant improvement than Group B.

Discussion

Lumbar MRI was the standard procedure for the demonstration of stenosis [19]. In the present study, a total 30 subjects with mean age (in years) 38.53 ± 8.37 were participated in the study in which 10 were females and 20 were males. The Mean and SD of age (in years) for Group A (Experimental) and Group B (Control) were 37.47 ± 7.78 and 39.60 ± 9.08, respectively. The mean age of the subjects included in the study signifies that LSS were commonly occur after the 3rd decade of life while physiology supports that the LSS commonly occurs after the 6th decade of life as a result of degeneration. The reason behind the early occurrence of LSS was sedentary lifestyle, occupation, smoking habit and ergonomically challenges posture [20].

The present findings were similarly attained by the Reiman et al. [17], in his systematic review which shows that by using TENS to improve intensity of pain among LSS patient. In Group A, Cryotherapy was used to improve the intensity of pain among LSS patient. The application of cryotherapy reduces the intensity of pain by the means of pain gate mechanism and also decrease the inflammatory response associated with cause of LSS [21]. Cryotherapy was helpful in relieving in decreasing intensity of pain among Low back pain. The similar findings

were observed by the Dehghan and Farahbod [22]. The conventional physiotherapy management was mainly focused on electrotherapeutic modalities and least on exercise therapy whereas integrated exercise protocol was based on cryotherapy and exercise regime to improve the spinal stability through strengthening the muscles. Present study was done to find out that an integrated exercise protocol was better than the conventional physiotherapy management for LSS patients. In group B, to improve the ROM of the Lumbar spine, the electrotherapeutic modalities along the exercises like knee to chest, pelvic rotation and pelvic bridging were used. It causes the stretching of para-spinal musculature and helps in improving lumbar ROM. there was a significant difference between the base line and post intervention score on MST i.e. there was improvement in ROM of lumbar flexion in group B. it was supported by Creighton et al. [9] and Reiman et al. [17] in their studies. There was a significant difference between the base line and post intervention score on MST i.e. there was improvement in ROM lumbar flexion in group A. The Straight Leg Raise (SLR) and Slump test was a common neurodynamic test used to examine the mechano-sensitivity of the lower extremity nervous system in individuals with low back or lower extremity pain [23,24]. So, in the present study, Slump test and SLR Neural Flexibility was used as an outcome measure to evaluate the effectiveness of conventional physiotherapy management and integrated exercise protocol on neural flexibility among LSS patients. There was a significant difference between the base line and post intervention score on SLR right and left leg i.e. there was improvement in neural flexibility in group B. That there was a significant difference between the base line and post intervention score on ST right and left leg i.e. there was improvement in neural flexibility in group B.

The QOL of the patients was hampered in LSS patients due to pain and associated symptoms which leads person dependent on others for their ADLs. In the Present Study, the Oswestry Disability Questioner (ODQ) was used to measure the disability occur due to LSS on the 5 levels of disability. It reveals that there was a significant difference between the base line and post intervention score on ODQ i.e. there was improvement in QOL in group B. It reveals that there was a significant difference between the base line and post intervention score on ODQ i.e. there was improvement in QOL in group A. The present findings were similarly attained by some researchers who concluded that the lumbar flexion exercises has been helpful in improving Quality of life of LSS patient. Creighton et al. [9] and Fritz et al. [25] shows significant physiotherapy intervention has effect in improvement of Quality of life among LSS patient.

Conclusion

In the present study the effect of an integrated approach and conventional physiotherapy treatment on LSS patient was evaluated. It has been found that the integrated exercise approach has a significant effect in improving pain, lumbar ROM, neural flexibility and Disability then a conventional physiotherapy treatment. So it has been concluded from the present study that the integrated exercise approach was better than conventional physiotherapy treatment.

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