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Original Research Article

Combined Effect of Flexion Exercises Along with Stationary Bicycling on Neurological Claudication in Lumbar Canal Stenosis

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Abstract

Background: Lumbar canal stenosis (LCS) is a painful and potentially disabling condition in older adults. Neurogenic claudication is usually caused by degenerative LCS, which refers to age-related degenerative narrowing of the spinal canals. The previous study shows that flexion-based exercise program has positive outcome in LCS in older adults. Based on the observation that cycling on stationary bicycle dose not elicits pain in people with neurogenic claudication. Hence the present study was undertaken to find out the combined effect of flexion exercises along with stationary bicycling on neurological claudication in LCS.

Methodology: An experimental study was carried on 20 patients of age >50 years diagnosed with LCS. They were randomly divided into two groups. Group A was given flexion exercises along with stationary bicycling and group B was given flexion exercises only. Both the groups were given hot pack and intermittent lumbar traction. Visual analogue scale (VAS) on 6-minute walk test and Modified Oswestry disability index score (M.O.D.I) for functional disability values were taken at baseline then on alternate day for 4 weeks.

Result: After 4 weeks of treatment, the mean of VAS on 6 min walk test for group A and group B was 3.9 and 5.2 respectively, which was statistically significant ($p<0.0329$) whereas the mean of M.O.D.I. disability index for group A was 21.4 and for group B it was 34.4, this was also statistically significant, ($P<0.0400$).

Conclusion: Flexion exercises along with stationary bicycling are more effective in reducing neurological claudication symptom and improving functional status by decreasing disability of patients with LCS in comparison with flexion exercises only.

Keywords: Neurogenic claudication, Lumbar canal stenosis, Flexion exercises, Stationary bicycling, VAS, M.O.D.I, Functional disability.

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1. Introduction

Lumbar canal stenosis (LCS) is defined as any narrowing of lumbar spinal canal, nerve root canal or intervertebral foramina. It is also called as lumbar spinal stenosis [1,2]. Classification of the disorder may be based on the location of the narrowing, either in the central or lateral canal, or on the etiologic of the stenosis, either primary or secondary. Primary stenosis refers to various congenital aetiologies whereas secondary or acquired stenosis is from degenerative, postsurgical (iatrogenic), spondylolisthetic, posttraumatic, or combined etiologies. The most frequently reported classification of LCS is that of degenerative etiology, especially among the elderly [2,3].

Moreover, in patients older than 60 LCS is found on magnetic resonance imaging in more than 20%of cases [4]. LCS is a prevalent condition, with an estimated 13% to 14% of those patients who seek help from a specialty physician and 3% to 4% who see a general practitioner for low back pain (LBP) diagnosed with LCS. The cause of spinal canal narrowing may be multifactorial.

Degenerative changes are typically involved, including facet joint hypertrophy, ligamentum flavum thickening and disc bulging and protrusion, alone or in combination [5]. The typical symptoms of LCS include Neurogenic claudication (NC), back and leg pain and mixed symptom [6].

The surgery for LCS associated with increased rate of mortality and morbidity. Many researchers and reviewers suggest that patients with LCS undergo a period of conservative therapy before considering surgical intervention. Although physical therapy is often the first recommended form treatment for persons with spinal stenosis, few studies have closely examined the effect of specific exercise programs on function outcome. Exercises that encourage lumbar flexion and flattening of lumbar lordotic curve can be of a clinical benefit to patients suffer from LCS [7, 8]. Physical therapy may be prescribed with the goals of improving strength, endurance, and flexibility. However, previous study shows that flexion-based exercise program has positive outcome in lumbar canal stenosis in older adults. Based on the observation that cycling on stationary bicycle dose not elicits pain in people with neurogenic claudication, many authors have traditionally advocated its use as a form of aerobic training [9].Hence the present study was carried out to find out the additional effect of stationary bicycling along with flexion exercises on neurological claudication in LCS. The basic objective of study was to reduce pain on walking due to neurological claudication and improvement in functional disability.

2. Materials and Methodology

An experimental study was carried on 20 patients of age above 50 years, presented with a history of low back pain (radiating or non-radiating symptoms), evidence of LCS on MRI or radiograph, positive lumbar extension test and positive for SLR during a period of 1 year. Also subjects who reported back or lower extremity pain while walking and during sustained (30 seconds) spinal extension in standing and who reported relief of their back or lower extremity symptoms in sitting compared with walking or standing and who were referred by the orthopaedic specialists to outpatient physiotherapy for management of degenerative LCS were recruited. Patients with severe osteoporosis, neo-plastic condition, spondylolisthesis with greater than 5 mm of slippage, vascular disease, and patient's undergone surgery for LCS were excluded from the study.

Subjects were informed about study and intervention Informed consent was taken in their own understandable language. Initial thorough physical examination includes demographic data were taken according to data collection sheet which includes special tests i.e., lumbar hyperextension test, SLR, stoop test [10]. Outcome measurements were taken before the treatment and after 4 weeks of treatment.

2.1 Modified Oswestry disability index score

It is a validated, patient completed questionnaire used to assess 10 parameters: pain intensity, personal care, lifting, walking/walking aids, sitting, standing, sleeping, sex life, social life and travelling. Scores are from 0 to 100% with higher scores meaning greater disability [11]. In ODI scoring patients must simply answer the questions by choosing the 'best answer that describes their 'typical' pain and/or limitations within the last week or two. They must choose only one answer. If their limitations fall in-between two questions, pick the higher point value question. After they have finished the test, add up their points, divide that number by 50, and multiply by 100 to get their percent of disability. Simply add up their points for each section and plug it in to the following formula to calculate their level of disability. Total point/50 X 100=% disability.

2.2 Visual analogue scale (VAS) on 6-minute walk test

Patient was asked to walk with their comfortable level on distance of 10 meter on flat surface in 6 minutes, patients have to report their pain on VAS during walking [12]. Both outcome measures were recorded on data collection sheet.

A total number of 20 subjects with LCS were divided in two groups (10 subjects in each group) by simple random sampling method. Group A (experimental Group) included 6 male and 4 females, treated with flexion exercises and static bicycling. Initially thermotherapy was given to back by using hot pack for 15 minutes in supine lying position to improve the tissue elasticity. Then intermittent lumbar traction was given in 90-90 degree of hip and knee flexion, force was applied according to 1/3 of body weight withhold time 20sec and relax time 10sec for 15 minutes [13]. For the flexion exercises position of the subjects was in supine lying, subjects were asked to perform single knee to chest exercises. Subjects were asked to lie flat on back, with knees bent and feet flat on the floor. They were instructed to pull left knee near to chest and hold for 10 seconds and release the knee and place foot back on the floor. Subjects were asked to do with alternate sides and repeat the process with right leg, also instructed to repeat the exercises for 10 times with each leg. After this in the same position, double knee to chest exercises were performed. Double knee to chest was performed similarly to single knee to chest. Once again, subjects were asked to bent knees and feet on the floor and pull left knee near to chest. Subjects must maintain the left knee in place, and slowly bring right knee near to chest as well. Maintain this position for 10 seconds. They should feel a stretch to lower back. Repeat these exercises for 10 repetitions [14].

Stationary bicycling was done on stationary bicycle with 50 to 60 rpm in forward bending position for 10 min with 2 min rest in between [14, 15]. Group B (Control group) included 3 males and 7 female treated with flexion exercises only. Initially subjects were treated with thermotherapy and intermittent lumbar traction same procedure was used as per explained above. The procedure for the flexion exercises were same for group B as per the group A. Treatment for both the groups were given on alternate day for 4 weeks. After completion of the treatment protocol reassessment of outcome measures were done.

2.3 Statistical Analysis

Data analysis and interpretation was done by using paired t test for within the groups and unpaired t test between the groups. For the significant difference P value was calculated. Data analysis was done by using Instat Software version3.06.

3. Observations and Results

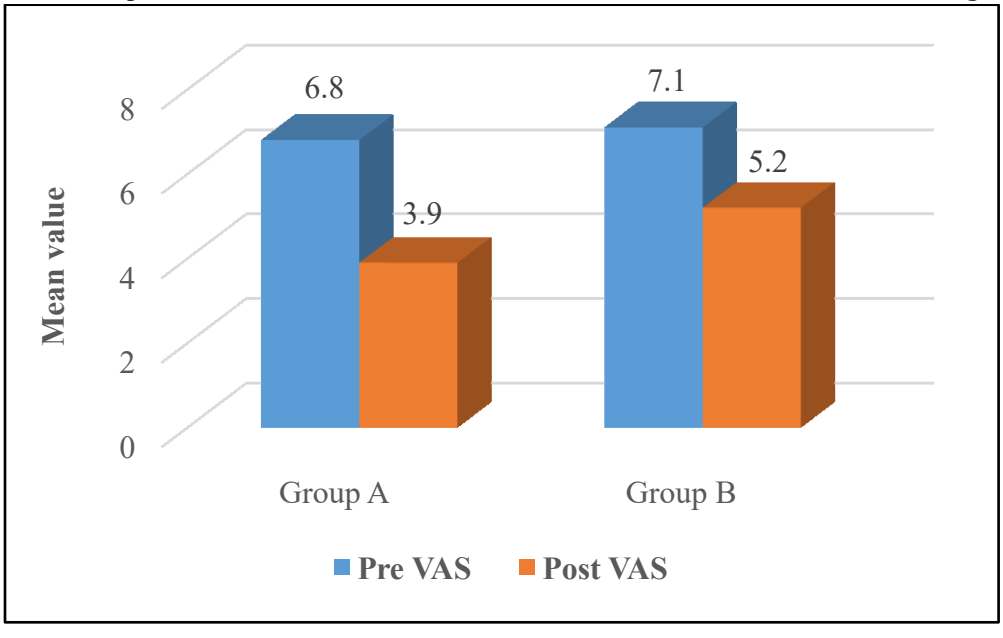
A total of 20 patients with LCS were included in the study, of them 11 were females and 9 were male. All the patients were above 50 and mean age of patients in both the groups are shown in table 1 and the difference was not statistically significant, (p value=0.7968).

Table 1: Demographic profile of the patients

Demographic data		Group A	Group B
Mean age (years)		57.8±6.647	58.7±8.629
Gender (N)	Male	06 (66.66%)	03 (33.33%)
	Female	04 (36.36%)	07 (63.63%)

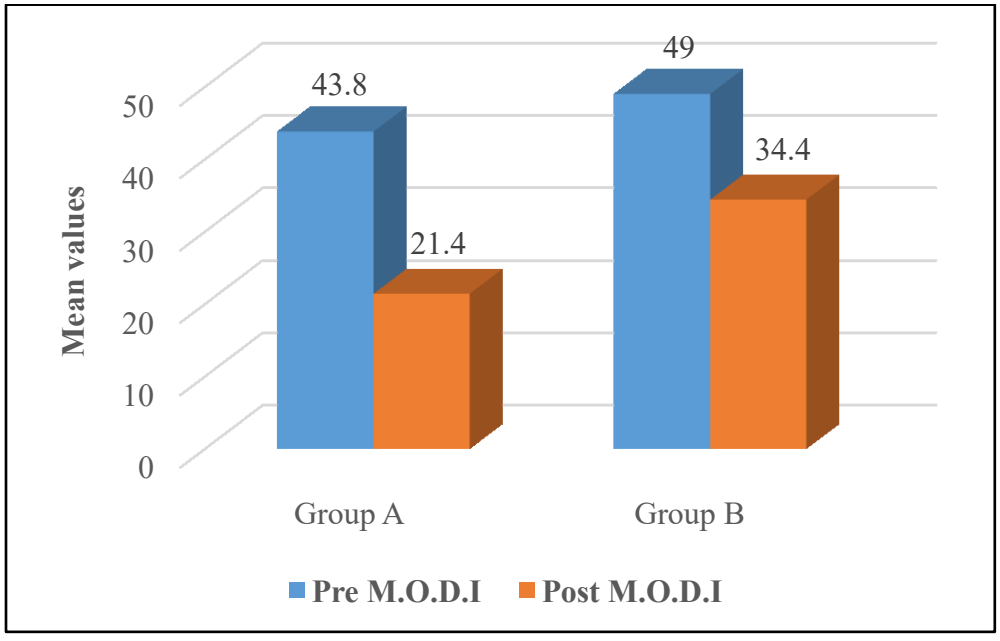
There was significant difference in the pre and post treatment measurement for VAS on 6 min walk test in group A (P<0.0001) and in group B (P<0.0001). From the figure 1 it was observed that the pre values of group A and group B were compared, it shows no significant difference between the groups while comparing post VAS on 6-minute walk test of group A and group B shows that there was significant difference.

Figure 1: Comparison of Pre and Post measure for VAS on 6 min walk test between two groups



There was significant difference in the post treatment compared to pre-treatment measurement of M.O.D.I. score in group A (t=12.220, P<0.0001). Also, there was significant difference in the post treatment compared to pre-treatment in group B (t-19.909, p<0.0001). However, the pre M.O.D.I. score of group A and group B were compared between the groups by applying unpaired 't' test (t=0.7850,P<0.4427) which shows no significant difference while compared post M.O.D.I. score between the two groups, shows significant difference, (Figure 2).

Figure 2: Comparison of Pre and Post treatment measurement of M.O.D.I. score between group A and group B



4. Discussion

Lumbar canal stenosis is a common degenerative condition in the elderly and is associated with narrowing of the spinal canal or nerve root canal caused by degenerative arthritis changes of the facet joint and intervertebral disc [10]. Ongoing through previous evidence, some studies Whitman *et al* as well as DuPriest *et al* have concluded that flexion exercises are beneficial for LCS [16, 17]. Based on the observation that cycling on stationary bicycle dose not elicits pain in people with neurogenic claudication. The success of endurance exercise in other conditions and the relative comfort that older patients with CLBP experience in lumbar flexion suggest that a bicycle exercise program may improve functional status [14]. There are a smaller number of literatures on using flexion exercises and cycling these two strategies for the management of LCS. Many studies have not explained the effect of flexion exercises on neurological claudication specially [18,19]. Hence considering the above points, in present study total 20 patients (9 males, 11 females) diagnosed as LCS, of age above 50 years were studied.

Both the groups were received hot pack and intermittent lumbar traction as base line treatment. Pre-treatment outcome measures 6 min walk test for pain due to neurological claudication and M.O.D.I. score was taken for functional disability. Post treatment outcome measure was taken after 4 weeks. In statistical analysis pre-treatment outcome measures was compared between the two groups by using unpaired 't' test which showed that there was no significant difference. The outcome measure pre-treatment VAS on 6-minute walk test in group A was compared with pre-treatment in group B by using unpaired 't' test which showed no significant difference before the treatment. Another outcome measure M.O.D.I. score in group A was compared with pre-treatment in group B by using unpaired 't test which showed no significant difference before the treatment.

After the completion of treatment duration of 4-week pre and post outcome measures were compared by using paired 't' test in both groups to see the effectiveness of the treatment. In experimental group which received flexion exercises along with stationary bicycling and base line treatment of hot pack and intermittent lumbar traction in which pre and post treatment outcome measure VAS 6 min walk test was compared by using paired 't' test signified that there was significant difference. In the same group M.O.D.I. score was compared before and after the treatment by using paired 't' test which also showed significant difference which is comparable with the study done by Ammendolia *et al* [20]. In control group which received flexion exercises only in which pre and post treatment outcome measure VAS 6 min walk test was compared by using paired 't test signified that there was significant difference. In the same group M.O.D.I. score was compared before and after the treatment by using paired t test which showed significant difference. After the comparison within the group, comparison was done between the groups.

VAS on 6 min walk test was compared between experimental and control group by using unpaired t test which showed the significant difference. There was significant reduction in pain on VAS 6 min walk test in experimental group than control group. Another outcome measure M.O.D.I. score was compared between experimental group and control group by using unpaired 't' test which showed the significant difference. Hence the experimental group showed better improvement in the functional disability in the patients with LCS. Though the flexion exercises have positive outcome in patients with

LCS there was no significant reduction in neurological claudication symptom. When addition of stationary bicycling in forward flexed posture and flexion exercises showed significant improvement in functional disability and reduction in neurological claudication symptom.

The overall decrease in percentage (%) of disability on Modified Oswestry disability index was observed in group A compared with group B. Hence it can be stated that, the flexion exercises along with cycling aid reduces neurological claudication, overall disability and shows improvement in functional status of patients with LCS. The limitation of this study was small sample size and patients were homogeneous.

5. Conclusion

Based on statistical analysis and interpretation of data, study can be concluded that flexion exercises along with cycling are more effective in reducing neurological claudication symptom and improving functional status by decreasing disability of patients with LCS in comparison with flexion exercises only. Clinical improvement is seen significant in cycling and flexion exercise group. Hence the alternate hypothesis was accepted.

Further extensive study should be carried out using large sample population to see the long-term effect. Study on specific conservative management including physical therapy should be carried out and a comparative study also should be done by using two therapeutic interventions for management of lumbar canal stances.

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