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Effect of Hip Flexor Muscles Strengthening and Femoral Nerve Sliding on Lumber Lordosis and Low Back Pain

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ABSTRACT

Background: Lower back pain (LBP) is a world-wide problem related to health and it's most common as well as pricey musculoskeletal condition or disorder in the today's societies. By far, the most common cause is mechanical factor (97%). While reflexive activity of the psoas muscle may be because of adverse neural tension in the femoral nerve and its roots, adaptive shortening in the psoas muscle may also results in limitations in neural mobility. This study has been done to evaluate the effect of hip flexor muscles strengthening and femoral nerve stretching/sliding on LBP and lumbar lordotic curve.
Methods: This was an experimental study type study in which 30 eligible subjects were taken as per inclusion and exclusion criteria and randomly divided into 2 groups (15 in each). The pre and post-test measurements including Visual Analog Scale (VAS), Roland- Morris Low Back Pain and Disability Questionnaire and were done regarding pain and disability respectively. Along with this lumbar lordotic curve was measured using flexible ruler in each group. The control group was given conservative treatment with some general core strengthening exercises and home advice, while experimental group was given hip flexors strengthening exercises (in sitting), femoral nerve sliding/stretching in addition to the control group's protocol for 4 weeks. Results were analyzed using Kolmogorov-Smirnov and t-tests.
Findings: On comparing both groups post treatment results showed a significant improvement in terms of RMQ and VAS scores and also changes in the LLA (Lumbar Lordotic Angle). Overall outcome of this study proved that conservative treatment (with some core exercises), hip flexor muscles strengthening and femoral nerve sliding are helpful for non- specific LBA subjects.
Interpretation: The results obtained showed that experimental group (conservative treatment, hip flexor muscles strengthening and femoral nerve sliding) showed slightly more improvement in comparison to control group (conservative treatment with some core exercises).

Keywords: Low back pain, Hip Flexor Muscles strengthening, Femoral nerve sliding, RMQ, VAS, Flexible ruler.

INTRODUCTION

Lower back pain (LBP) is a world-wide problem related to health and its most common as well as pricey musculoskeletal condition or disorder in the today's societies. The prevalence rate of LBP is estimated about 10 to 80% depending upon the population. For a balanced motor system is there is need of coordinated activity of synergist and antagonist muscles. The normal trunk functioning depends on passive joint mobility, normal muscular activity and also on the central nervous system adjustment. With focus to this point

of view, repetitive movements, long-term incorrect postures habits and movements can cause change in muscle tissue characteristics that lead to muscle dysfunction, altered pattern of movement, pain and lastly movement disorders. Hence, the main emphasis recently has been placed on assessment of the altered movement pattern in people with musculoskeletal pain and disorders like LBP and also on the importance of having normal of movement pattern for the prevention and treatment of Low back pain. Coordination among the muscles of lumbo-pelvic region is thought to be behind the balancing position of pelvis in normal posture and also during the trunk or lower limb movement. There are Several studies that have demonstrated the fact that LBP is associated with changed activation pattern of the lumbo-pelvic muscles during different tasks and muscular imbalance (1).

Nevertheless, 85% of people having isolated back pain still do not have a definitive cause diagnosed for their symptoms. The etiologies can be further divided into mechanical, referred and systemic groups. By far, the most common cause is mechanical factor (97%) with the most common form as "non-specific LBP". This definition can be used when the causative reason of the pain cannot be precisely determined and is based upon the exclusion of patients having a specific cause (e.g., fracture, cancer, infection). Non-specific type of LBP is commonly described as pain or discomfort localized to the area of posterior aspect of body, from the lower border of the twelfth rib to up to lower gluteal folds, with or without pain referring into one or both lower limbs, which lasts for duration of at least 1 day. Non-specific LBP is classified as per the duration in acute (pain lasting less than 6 weeks), sub-acute (6 to 12 weeks), and chronic (more than 12 weeks) types. Acute LBP is one of the most common factors for adults to consult a general practitioner because of moderate to severe discomfort and debilitating psychological and motor functions. The worldwide point prevalence of LBP is 9.4% in 2010 and was higher in males and the elderly ones, exceeding up to 30% in 80-year-old men in Europe. Despite of the widespread occurrence, acute LBP is typically self-limiting, and with a recovery rate of 90% within 6 weeks of the early episode, whereas 2 to 7% patients develop chronic stage LBP and with a high risk of recurrence. The progression towards chronicity is related with high disability and costs for the society. Estimated DALYs (disability-adjusted life year) ranged from 58.2 million (in 1990) to 83.0 million in 2010. In fact, LBP results in a greater number of people that leave the labor force than diabetes, hypertension, asthma, neoplasms and heart, respiratory diseases combination (2).

Furthermore, poor coordination of the paraspinalis muscles is also associated with chronic LBP. These factors contribute to a vicious cycle of back pain and deconditioning syndrome. Exercise can help to improve back extension strength, endurance, mobility and functional disability. Various exercises, like lumbar stabilization exercise (SE), motor control exercise, lumbar flexion exercise, core exercises, walking exercise (WE), and bracing exercise, have been considered to mitigate chronic LBP. To get better compliance, the intensity grade of each exercise can be modified as per need of each patient's capacity, with changes in the postures of the both upper and lower extremities and neck as well as some changes in the duration or time of exercises. Moreover, walking is recommended for rehabilitation of patients with LBP. It is relatively more easy to comply with and also it's highly cost-effective. It leads to an Increased isometric endurance by enhancing muscular endurance and are potentially able to prevent LBP (3).

A person's hip flexors are the muscles around the ball and socket joints that interlink the legs to the upper body. A person should keep the hip flexors well-stretched and strong in order to avoid injury and prevent existing injuries getting worse.

Controversy still exists related to the cause of the decrease in movement's range. Elvey et al. suggested that it may be a result of secondary protective muscle spasm due to the increased stimulation of the nerve prior to movements (4).

Dysfunctions affecting the nerves can occur chemically or mechanically, and they can be intra or extra neural. It must also kept in consideration that the relationship between adverse neural tension signs and psoas musculature dysfunctions may be bidirectional. While reflexive activity of the psoas may be because of adverse neural tension in the femoral nerve and its roots, adaptive shortening in the psoas may also results in limitations in neural mobility. Pain felt in the anterior thigh during the PKB may indicates tight quadriceps muscle or stretching of the femoral nerve. Although previously neural tension has been studied in the upper limb and regarding the sciatic nerve in the lower limb, the femoral nerve has gone relatively unnoticed (5).

Low back pain (LBP) can affect motor control of trunk muscles that are responsible for spinal movements and stability. Core stability exercises (CSEs) in Low back pain rehabilitation have become popular as the observed changes in abdominal muscle activation patterns in the presence of back pain (6).

Physical therapy, exercise and stretching are foundational components of most of the lower back pain treatment regimens. Heat therapy is applied to the lower back immediately prior a physical therapy session and it is also advisable to apply heat before exercising or stretching. In addition, frequent heat therapy application at home makes it possible to exercises more easily, in between and also long after physical therapy sessions. By facilitating consistent and completion of exercises, heat application is bound to improve the overall output of physical therapy for neck and back pain. Heat therapy can help to reduce mental stress, as observed by cortisol levels in the blood, and also decrease the oxidative stress on a chemical level.

MATERIALS AND METHODOLOGY

Study Design

This was an experimental type of study, designed to determine the effect of Hip Flexor Muscles strengthening and femoral nerve sliding on low back pain, disability and on lumbar lordosis curve in patients with chronic low back pain. Total 30 subjects were randomly chosen (both male & female gender) from local population in nearby area. Further divided into 2 groups (15 each) as control group and experimental group. A written informed consent was also taken and after then exercise protocol was explained and required parameters were recorded. Parameters recorded were:-VAS (Visual Analogue Scale) score, RMQ (Rolland Morris Questionnaire) score, BMI, Age and Lumbar Lordotic Angle (LLA, in prone lying as well as prone lying knee bending position). VAS, RMQ and LLA were recorded again after 4 weeks protocol completion. For lumbar lordotic curve angle investigation, dominant leg was chosen. A standard flexible ruler was used to measure the lordotic curve and for this purpose, subject was asked to lie in prone position (by arms along the sides) on a treatment table. The removable stickers were applied on the L1 spinous process and base of sacrum after the palpation. A standard flexible ruler was placed over L1 and S1 spinous processes along the subject's lumbar curve. Then the curve of the ruler was graphed on the paper that resembled the subject's lumbar curve and L1, S1 were located as reference points. The method explained by previous studies (12) was used to quantify the size of lumbar lordotic angle (LLA). 2 points on the curve representing L1 and S1 were connected by a line (L) and a vertical line (H) representing the height of lumbar curve, bisecting L was drawn. The measured values were used in the following formula:- =4{Arctan (2H/L)}

The treatment protocol was applied after the parameters were recorded in both the groups. Control group (N=15) was given conservative treatment (including moist heat, general core strengthening exercises/ lumbar stabilization exercises and walking). The experimental group (N=15) was given hip flexors strengthening exercises (in sitting) of 3 sets, 10-15 repetitions and femoral nerve sliding/stretching (3 repetitions of 30 seconds); along with the conservative treatment same as control group for 4 weeks, 4-5 times/week. Hip flexors strengthening exercises:- the patient position was in sitting comfortably. An elastic resistive band was used to do this exercise. The elastic band was wrapped around the above knee region of the exercising leg. The other side of the resistance band was stabilized by the subject's foot of the other leg. Then subject was asked to lift the leg against the resistive band for 3 sets of 15-20 repetitions. Subjects were explained about the fatigue in the posterolateral hip region while performing this activity.

For femoral nerve sliding the initial technique of neural mobilization should be of non–provoking without causing an increase in patient symptoms. There should be continuous monitoring of symptoms with constant verbal and non-verbal communication between the therapist and patient. A common slider technique for manually gliding the proximal aspect of the femoral nerve involves placing the patient on their contralateral side. The therapist stands behind the patient with cephalad hand supporting and monitoring the ipsilateral hip and pelvis as the caudal hand supports the ipsilateral side. The therapist then passively brings the hip into extension and performs slow and rhythmic oscillations. 3 repetitions of 30 seconds were performed in each session for 4 weeks for 4 weeks.

Statically analysis

After the completion of protocol and findings, we used Kolmogorov-Smirnov test to check the normality of distribution. Then we used Parametric T-test and Paired T-test for further calculation of significance level and differences in control and experimental groups findings.

RESULTS

Firstly Kolmogorov-Smirnov test was conducted to test the normal distribution of data. As shown in Table 1, all the variables are normally distributed (as p >0.05).

Table 1 Kolmogorov-Smirnov

	Statistic	df	p - value
VAS (Pre)	.134	30	.182
RMQ (Pre)	.119	30	.200*
LLA (Pre) PL	.139	30	.145
LLA (Pre) PKB	.140	30	.137
VAS (Post)	.175	30	.020
RMQ (Post)	.139	30	.142
LLA (Post) PL	.148	30	.094
LLA (Post) PKB	.150	30	.085

Table 1 Showing normal distribution of the data

Table 2 showing Paired t- test values

Paired -T test						
Group		N	Mean	St. Deviation	t- value	p- value
Control	VAS(pre)	15	6.267	1.580	4.183	.001**
	VAS(post)	15	5.267	1.280		
Experimental	VAS(pre)	15	5.133	1.846	4.219	.001**
	VAS(post)	15	3.867	1.246		
Control	RMQ(pre)	15	16.733	1.870	6.788	.0001**
	RMQ(post)	15	14.267	1.580		
Experimental	RMQ(pre)	15	14.600	3.180	7.756	.0001**
	RMQ(post)	15	12.000	3.024		
Control	LLA(pre) PL	15	25.533	6.763	15.888	.0001**
	LLA(post)PL	15	27.600	6.659		
Experimental	LLA(pre) PL	15	23.100	2.856	7.710	.0001**
	LLA(post)PL	15	23.987	2.620		
Control	LLA(pre)PKB	15	27.747	6.648	7.719	.0001**
	LLA(post)PKB	15	29.713	5.929		
Experimental	LLA(pre)PKB	15	24.773	2.891	8.957	.0001**
	LLA(post)PKB	15	25.427	2.912		

There was significant change in Pre and Post values of VAS scale in both controlled and experimental groups with p-value 0.001. There was significant change in Pre and Post values of RMQ questionnaire in both controlled and experimental groups with p- value 0.0001. There was significant change in Pre and Post values of LLA (PL & PKB) in both controlled and experimental groups with p-value 0.0001. As shown in Table 2.

There was significant difference in post VAS values of both controlled and experimental groups with p value 0.005. There was more decrease in experimental group (mean value varies-5.133 to 3.867) as compare to controlled group (mean value varies-6.267 to5.267). There was significant change in post RMQ values of both controlled and experimental groups with p value 0.016. But there was slightly more decrease in RMQ values of experimental group than controlled one as the mean values varies as; controlled group (16.733-14.267) and experimental group (14.600-12.000). There was not any significant difference of LLA (Post) PL in both the groups. However, in control group there is slight increase (mean varies as 25.533 to 27.600) and in experimental group its almost same (mean value varies as 23.100-23.987). There was significant difference in LLA (Post) PKB values in both the groups with p value 0.018. However, its slight more in controlled group (mean value varies as 27.747 to 29.713) than experimental group (mean value varies as 24.773 to 25.427). Shown in Table 3 and Figures (1, 2, 3 and 4).

Table 3: Showing t- test values

T- test						
	Group	**N**	**Mean**	**St. Deviation**	**t-value**	**p-value**
VAS(pre)	Control	15	6.267	1.580	1.806	.082
	Experimental	15	5.133	1.846		
VAS(post)	Control	15	5.267	1.280	3.036	.005*
	Experimental	15	3.867	1.246		
RMQ(pre)	Control	15	16.733	1.870	2.240	.033*
	Experimental	15	14.600	3.180		
RMQ(post)	Control	15	14.267	1.580	2.573	.016*
	Experimental	15	12.000	3.024		
LLA(pre)PL	Control	15	25.533	6.763	1.284	.210
	Experimental	15	23.100	2.856		
LLA(post)PL	Control	15	27.600	6.659	1.956	.061
	Experimental	15	23.987	2.620		
LLA(pre)PKB	Control	15	27.747	6.648	1.588	.123
	Experimental	15	24.773	2 891		
LLA(post)PKB	Control	15	29.713	5.929	2.513	.018
	Experimental	15	25.427	2.912		

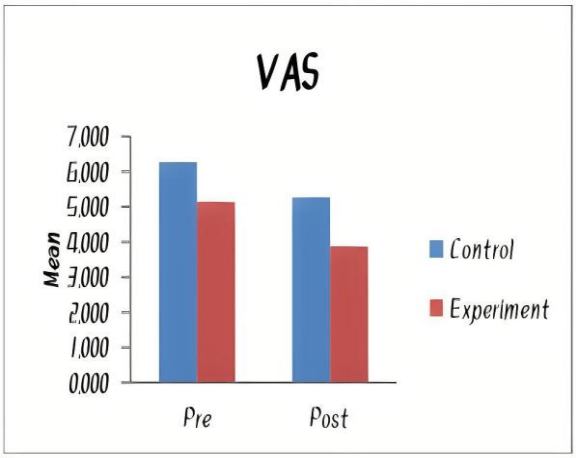

Figure 1 Showing Pre and Post VAS scores

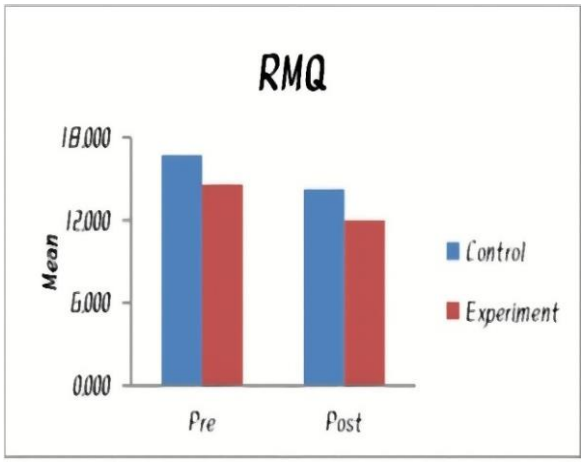

Figure 2 Showing Pre and Post RMQ scores

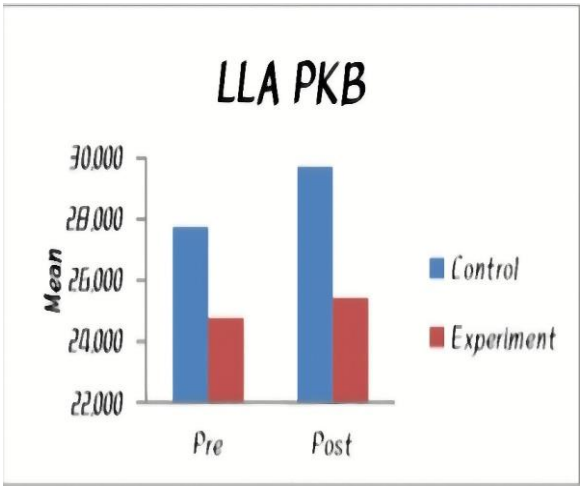

Figure 3 Showing Pre and Post LLA (PKB) values

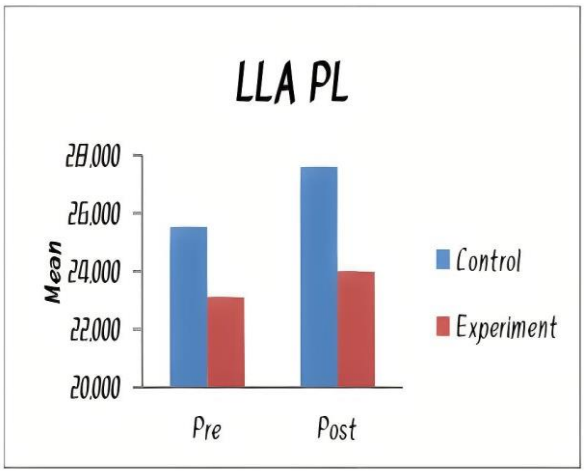

Figure 4 Showing Pre and Post values LLA (PL) values

DISCUSSION

The purpose of this study was to investigate the effect of hip flexor muscles strengthening and femoral nerve sliding on lordotic curve and LBA. As per our findings conservative treatment and lumbar stabilization exercises resulted in significant decrease of VAS and RMQ scores, in both controlled and experimental groups. This finding is supported by Hassan et al. 2013, Hannu et al. 2010, Kotagiri et al. 2019. According to these studies also, there was decrease in disability and pain after the application of lumbar region specified exercises. So it is clear in vision that lumbar region specified or core exercises are helpful to aid pain and disability in chronic non-specific type of lower back pain. In our findings RMQ score and VAS score as slightly more decreased in experimental group than control one, it might be because of neuro physiological mechanics (according to Sterling et al. 2001). As neural mobilization is a hypoalgesia and concurred symptom as excitation and it has been previously proposed that sympathetic excitation hypoalgesia and increase in motor functions are indirect signs of possible involvement of endogenous pain inhibitory system, so neural mobilization technique was used to improve altered neurodynamics. This is supported by Sreenivasu et al. 2019. Hence, it shows that neural mobilization techniques or nerve sliding techniques are useful in improving patient's functions and in reduction of disability due to chronic non-specific low back pain. Our study showed significant increase in lumbar lordotic curve (LLA) in both controlled and experimental groups, this means conservative treatment and lumbar stabilization exercises helps to aid the recovery of LLAs. This finding is supported by some previous studies also (Hwang et al. 2005, Igsoo et al. 2015). But in our findings LLA was increased to slightly more extent in controlled group than experimental group after the treatment or protocol completion of 4weeks, this could be because of the reason that femoral nerve stretching helped in hip flexion muscles relaxation and that might result in release of lumbar and pelvic range of motion and by posterior pelvic tilt pelvic angle have been recovered (also supported by Samantha Baker et al. 2019). The result indicates that measuring the LLA is helpful in diagnosing patients with LBA and then for assessment purpose after the treatment completion. Along with these findings, in our study we find out that strengthening of hip flexor muscles can also be useful in aiding low back pain and disability resulted by chronic back conditions. It is also supported by Sang et al. 2015. In their study they also found that hip joint muscles strengthening was beneficial to in helping patients of low back pain. So we can consider that chronic low back pain patients show restricted lumbar and hip region range related restrictions. And when lumbar

stabilization exercise, along with hip flexors strengthening and femoral nerve stretching (that can be helpful in muscles relaxation mechanism and pelvic-hip range of motion improvement) are applied there is decrease in low back pain and disability index. So we can consider that lumbar and hip region related combined protocol should be taken in to consideration for evaluation and therapeutic interventions in chronic low back pain patients.

CONCLUSION

Based on the results and discussion, present study can be concluded with following points: Both the protocol of control group (lumbar stabilization exercises & conservative treatment) and experimental group (LSE, conservative treatment, hip flexors strengthening and femoral nerve stretching) are helpful in reducing pain (VAS) and disability (RMQ) in low back pain cases. The experimental group protocol was slightly more successful in decreasing pain and disability scores in LBA. In both groups there was increase in LLA (post) after protocol completion but there was slightly more increase in LLA of control group.

Limitations of the study

There are some limitations of the present study including low number of subjects participating in the study, age group and some other specifications. Further research should be done with greater number of subjects, specific age group and with consideration of anthropometric measures.

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Conflict of Interest: None

Source of Funding: None

Ethical Approval: As per the Ref. No IAMR/22/4072 Institute of Applied Medicine and Research given the ethical Clearance for the research. There is no funding and no Conflict of interest.

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