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A Comparison of the Immediate Changes in Subjects with Chronic Lower Back Pain Effected by Lower Back Pain Exercises and Direct Stretching of the Tensor Fasciae Latae, the Hamstring and the Adductor Magnus

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Abstract. [Purpose] The purpose of this study was to compare the immediate changes in subjects with chronic lower back pain following lower back pain exercises and direct stretching of the tensor fasciae latae, the hamstring and the adductor magnus. [Subjects] The subjects were nine sufferers of chronic lower back pain (five female, four male) as well as eight healthy adults (six male, two female) as the control group. [Method] Exercise therapy with proven effectiveness was performed as the control intervention and direct stretching of the tensor fasciae latae, the hamstring and the adductor magnus was performed as the experimental intervention in a randomised controlled trial. Six items of evaluation pain measured on a Visual Analogue Scale (VAS), Finger Floor Distance (FFD), maximum pelvic anterior inclination, maximum pelvic posterior inclination, pelvic range of motion and posterior lumbar flexibility (PLF) The results were compared using Student's were measured before and after the intervention. The six items of evaluation were carried out in a random order. A t-test was used and a significance level was set at below 5%. [Results] A significant improvement in VAS, FFD, maximum pelvic anterior inclination, maximum pelvic posterior inclination, pelvic range of motion and PLF were observed in the chronic lower back pain group after the experimental intervention. However, the only improvement observed after the experimental intervention in the control group was in FFD. There were no significant changes in either group after control intervention. [Conclusion] This study has suggested that direct stretching of the tensor fasciae latae, the hamstring and the adductor magnus may have an immediate effect on chronic lower back pain.
Key words: Chronic lower back pain, Direct stretching pain

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INTRODUCTION

Is it said that 80–85% of the adult population is affected by or experiences lower back pain[1)]. Amongst them, there are even cases of severe acute lower back pain where the sufferer has difficulty even turning over in bed, let alone walking. As well as physical therapy, management of daily life and exercise guidance, manipulative physiotherapy is often performed with the purpose of alleviating pain in the clinical practice of physiotherapy[2)]. It has a good prognosis, rapidly relieving pain of rapid onset and unknown causes in a relatively short time. This type of lower back pain, including the so-called "slipped disc", is believed to originate from sacroiliac joint pain, lumbar facet joint pain, myofascial lower back pain or acute trauma of the annulus fibrosus disci intervertebralis, etc[3)]. Amongst these, lower back pain originating from facet joint is the most common, comprising 70–80% of all lower back pain cases[4)]. On the other hand, treatment of chronic lower back pain is often difficult due to psychological and economic factors as well as functional impairment resulting from pathological changes in the tissue constituting the lumbar spine.

The first choice of treatment for both acute and chronic lower back pain is conservative treatment mainly consisting of physical therapy[5)]. Rest, medication, block injections, traction therapy and physical therapy are implemented and guidance on Williams' exercises, muscle strengthening, with a focus on the abdominal muscles, and stretching is given and is performed according to the reduction in pain[5)]. However, amongst previous studies, there have been reports that the continuation of daily life is more desirable than aggressive exercise therapy for the treatment of acute lower back pain[2)]. On the other hand, it has also been clarified that the effect of exercise therapy centred on trunk muscle and stretching exercises on chronic lower back pain is greater than the effect of nonsteroidal anti-inflammatory drugs

Table 1. Characteristics of the subjects

	Chronic lower back pain with patients	Controls
age	31.1 ± 4.5	22.4 ± 4.8 *
Height(cm)	164.7 ± 7.7	173 ± 4.0
Weight(kg)	58.7 ± 8.8	66.3 ± 7.8
BMI	21.6 ± 2.4	22.1 ± 2.4

* $p<0.05$

(NSAID)[6–8]. Whether the pain is acute or chronic, the goal of treatment is to alleviate pain[7]. However, we haven't come across any studies that have examined the immediate changes from muscle strengthening and stretching exercises carried out as the patient's own voluntary training[7,8]. Clinically, we are experiencing immediate improvements in posture and gait in addition to pain relief in patients with acute and chronic lower back pain with no neurological signs present in the legs through direct stretching of the tensor fasciae latae and the hamstring. However, there are few reports on the immediate changes and all have remained in the empirical stage.

The purpose of this study is to compare the immediate changes in nine subjects with chronic lower back pain following lower back pain exercises and direct stretching of the tensor fasciae latae, the hamstring and the adductor magnus.

SUBJECTS AND METHODS

The subjects were nine sufferers of chronic lower back pain (five females, four males) as well as eight healthy adults (six males, two females) with no symptoms of lower back pain (Table 1). Consent was obtained from all subjects after they had been informed of the purpose of this study.

Chronic lower back pain is defined as having symptoms of pain in the lower back for three months or longer[9]. As there are no clear diagnostic criteria for lumbar facet joint pain, it was comprehensively diagnosed from a combination of previous studies as well as plain X-ray imaging and physical observations. Diagnosis of lumbar facet joint pain was obtained from the fulfilment of the following three criterion: (1) Localised tenderness in the lumbar facet joints (interspinous height, about 2 cm from the midline) and pain in the multifidus muscle; (2) The absence of trigger points in the muscle displaying pain; (3) Limited anteflexion and retroflexion of the trunk, particularly limited torsion and retroflexion. In addition, (1) Cauda equine and nerve root compression symptoms; (2) Neoplastic disease of the spine and inflammatory diseases; (3) Medical illnesses such as endometriosis; and (4) Psychogenic backache were excluded as differential diagnoses. The control intervention was set as a period where exercise therapy previously found effective in randomised clinical trials[6–8] was performed. The content of the exercise therapy was as follows: (1) Abdominal exercise: Slowly raising the trunk from a supine position with the chin tucked and holding for approximately five seconds at a 45° angle; (2) Back exercise: Slowly raising the upper body from a prone position with the chin tucked and a pillow under the umbilicus and holding for approximately five seconds at a height of approximately 10 cm. Exercise (1) and (2) were performed for two sets of ten repetitions. (3) Hamstring stretching exercise: Bending one hip joint 90° from a supine position and slowly extending the knee joint while supporting the popliteal region with both hands and holding for approximately ten seconds at maximal extension. (4) Lower back stretching exercise: From a supine position, holding one knee with both hands, pulling it into the chest while breathing deeply and holding the position for approximately ten seconds. (5) Tensor fasciae latae stretches: With the assistance of a physiotherapist, extending and internally rotating the hip joint on the stretched side from a lateral recumbent position and holding for approximately ten seconds. Exercise (3), (4) and (5) were performed for two sets of ten repetitions on the left and right side. All exercises (1) – (5) were performed in approximately 30 minutes. As the experimental intervention, direct stretching of the (1) Tensor fasciae latae; (2) Hamstring; and (3) Adductor magnus was performed for about ten minutes per muscle. An approximately 30 second rest was taken every five minutes. The site of the stretching was the right and left muscle-tendon transition. For exercise (2) the site was the hard side of the hamstring under palpation. Adding transitive pressure in a vertical direction to the running of the muscle became a method of stretching the muscle directly while bypassing joint motion. Anti-inflammatory analgesics were prescribed as drug therapy and dosing continued. Six items of evaluation – Visual Analogue Scale (VAS), Finger Floor Distance (FFD), maximum pelvic anterior inclination, maximum pelvic posterior inclination, pelvic range of motion and posterior lumbar flexibility (PLF) – were measured in random order. The FFD measurement was carried out with the subjects instructed to bend forward without bending their knees, reach towards the ground with their fingertips and stop when they felt lower back pain. The distance between their fingertips and the ground was then measured. For pelvic inclination, the angle between the horizon and the line connecting the anterior superior iliac spine and greater trochanter was measured by a goniometer while the subject sat in a chair. The maximum pelvic anterior inclination and maximum pelvic posterior inclination were the angles at the time of maximum pelvic anteversion and retroversion while seated. The pelvic range of motion was the difference between the maximum pelvic anterior inclination and maximum pelvic posterior inclination. PLF test was used as an evaluation of posterior lumbar flexibility. This is a test where the leg starting position is a 45° bend in both hip joints and the hip joint of the highly-placed leg is flexed to examine whether or not the thigh can reach the chest without resistance. The angle at the time the patient complained of pain during flexion was recorded as the index of posterior lumbar flexibility.

A t-test was used for the immediate changes in each index between the control and statistical significance was accepted at values of $p<0.05$.

RESULTS

The baseline values of each index for the chronic back pain and the control groups are displayed in Table 2-a. The control group had significantly lower ($p<0.05$) FFD, pelvic anterior inclination, pelvic range of motion and PLF indices. Table 2-b displays the change in each index after intervention. No significant changes were observed in either group after control intervention. A significant improvement in all indices was observed in the chronic back group after experimental intervention. On the other hand, only a significant improvement in the FFD index was observed in the control group ($p<0.05$)

DISCUSSION

Noxious stimuli occurring in the facet joint are a factor that causes reflex spasm of the multifidus muscle, and findings of tenderness in the multifidus muscle are thought to be important[11]. The persistent lower back pain of these cases is thought to be a result of mechanical stimulation of the facet joint due to prolonged standing which caused a reflex spasm of the multifidus muscle. However, it is presumed that in chronic lower back pain such as in these cases, a vicious pain cycle is formed from the increased flight reflex and formation of new movement patterns due to the enhanced secondary pain at the spinal level, etc, in addition to persistent spasm of the multifidus muscle[12]. The intense pain caused along with reflex spasm of the multifidus muscle from noxious stimuli occurring in the facet joint leads to lumbar immobility. New movement patterns associated with the increased flight reflex are formed and the hip joint below the lumbar region is forced to move excessively as a compensatory function. Shortening and muscle spasm of the tensor fasciae latae increases iliotibial band tension and results in anterior inclination of the pelvis. In addition, shortening and muscle spasm of the hamstrings results in posterior inclination of the pelvis. Essentially, the simultaneous contraction of the two muscles reduces flexibility of the pelvis and increases lumbar stress in everyday life situations. We view the resulting compensatory muscle contraction around the hip joint as a secondary disorder and presume it is a factor that could lead to lower back pain becoming chronic and more intense. We believe that the manipulative extension of the tensor fascia latae and hamstrings in this study significantly increased the hip joint and pelvic range of motion and was tied to a decrease in lower back pain. The reason for focusing on extension at the muscle-tendon transition is because flexibility at that location is poor. A significant decrease in FFD was also observed in this study. Kippers et al[13] found a correlation between standing forward flexion of the body and leg elevation and extension, however stated that standing forward flexion of the body reflects hamstring expansibility and the correlation between standing forward flexion of the body and lumbar flexion is low. The immediate improvement in FFD in this study is thought to be a result of a change in hamstring expansibility. Another result of this study was a significant increase in the average PLF values. Generally, posterior lumbar flexibility decreases in cases of lumbar facet joint pain due to persistent spasms of the multifidus muscle and contracture of the facet joint itself. Increased posterior lumbar flexibility suggests relaxation of the multifidus muscle and improvement in range of motion of the lumbar facet.

Exercise therapy found effective in randomised clinical trials was performed as a control intervention but didn't result in major changes in any evaluation index. A trend of decrease was however observed in VAS. In the case of chronic lower back pain, it is also possible that the pain is caused by a decrease in muscle tissue flexibility and circulatory failure. We presume that the recovery in muscle tissue flexibility and the improvement in circulation were caused by the back exercises and stretches that were performed.

Table 2-a. The baseline values of each index for the chronic back pain and the control groups

	Chronic lower back pain with patients	Controls
VAS	5.4 ± 0.4	–
FFD (cm)	11.2 ± 5.7	1.93 ± 1.0*
pelvic anterior inclination (°)	72.0 ± 2.9	69.0 ± 3.9
pelvic posterior inclination (°)	90.2 ± 4.8	100.3 ± 3.8*
pelvic inclination (°)	18.2 ± 7.7	31.7 ± 7.7*
posterior lumbar flexibility (°)	110.2 ± 13.8	140.1 ± 7.8*

VAS: Visual Analog Scale. FFD: Finger Floor Distance.

Table 2-b. The change in each index after intervention

	Chronic low back pain with patients		Controls	
	Exercise therapy	Stretching	Exercise therapy	Stretching
VAS	4.8 ± 0.8	1.5 ± 0.9*	–	–
FFD (cm)	10.5 ± 7.7	3.4 ± 3.7*	1.9 ± 2.0	1.1 ± 1.5*
pelvic anterior inclination (°)	68.0 ± 7.9	62.8 ± 6.5*	65.0 ± 5.9	62.3 ± 5.6
pelvic posterior inclination (°)	95.2 ± 7.8	103.1 ± 8.9*	104.3 ± 4.8	107.1 ± 6.3
pelvic inclination (°)	27.2 ± 10.9	40.3 ± 11.1*	39.3 ± 7.8	44.9 ± 8.3
posterior lumbar flexibility (°)	114.2 ± 16.8	129.7 ± 17.2*	140.9 ± 8.8	143.9 ± 5.6

VAS: Visual Analog Scale, FFD: Finger Floor Distance.

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