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Original Article

Effects of Thoracic Mobilization and Manipulation on Function and Mental State in Chronic Lower Back Pain

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Abstract. [Purpose] The aim of this study was to evaluate the changes in function and mental state after thoracic mobilization and manipulation in patients with chronic lower back pain (LBP). [Subjects and Methods] Thirty-six subjects were randomly divided into mobilization group (group A), manipulation group (group B) and control group (group C). The Oswestry disability index (ODI) was used to measure the functional impairment of patients with LBP. A multiple spinal diagnosis was used to measure the range of motion (ROM) of vertebra segments. The Fear-avoidance beliefs questionnaire (FABQ) was used to investigate the mental state of LBP patients. [Results] Group A and group B were significantly different from group C in terms of the ODI. Between groups, there was no difference in ROM during trunk flexion. Group A and group B were also significantly different from the control group in extension ROM. The FABQ of group B was significantly different from that of group A. [Conclusion] Application of mobilization or manipulation to thoracic lumbar vertebrae has a positive effect on function, mental state, and ROM in patients with lower back pain.
Key words: LBP, Mobilization, Manipulation

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INTRODUCTION

Lower back pain (LBP) is a discomfort condition in the local region around the posterior ribs and upper pelvis. LBP, which is a term for overall pain related to the abnormal structure of lumbar vertebrae, is one of the most common medical problems in modern society[1)].

Sixty to 80% of adults complain of LBP, and first symptoms occur mainly in ages of 20–39 years. Once individuals are over 35 years old, elasticity of ligaments and joints around vertebrae is reduced and restricted, resulting in occurrence of lower back pain[2)]. Chronic lower back pain is defined as the LBP lasting over 3 months, and this pain could lead to social problems because treatment of LBP has many costs[3)].

Some of the causes of the chronic LBP include excessive physical activities, muscle weakness in abdominal lumbar region, improper working environment, and direct trauma. In addition, some conditions such as long periods of sedentary lifestyle, abnormal posture, excessive tension of muscle, and abdominal obesity can contribute abnormal contracture, which leads to lower back pain[4)]. Furthermore, increased kyphosis reduces the mobility of the trunk, and as a result, abnormal movement of the lumbar vertebrae appears as a compensation movement[5)]. This abnormal movement makes the instability of facet joints more severe, and then lower back pain easily occurs[6)].

Although it is reported that manual therapy needs to be applied to the thorax of patients with LBP, there is still lack of studies about increasing the stability of the lumbar region by improving thoracic mobility, which results in a decrease in abnormal movement between vertebrae. In addition, manipulation or mobilization were used separately in previous studies about the effects of increased thoracic mobility in chronic LBP patients. Thus, it has not been known which therapy is more effective. For this reason, the purpose of this study was to evaluate the changes in function and mental state after thoracic mobilization and manipulation in chronic lower back pain patients.

SUBJECTS AND METHODS

Subjects

Out patient who suffered from chronic LBP for more than 12 weeks were recruited in this study. Thirty-six subjects were randomly divided into a mobilization group (group A), manipulation group (group B), and control group (group C). Subjects who were diagnosed with disc herniation, who had been surgically treated, and who had a fracture or abnormal structure of the neural system were excluded (Table 1). This study was conducted after a suffi-

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Table 1. The general characteristics of the subjects (mean±SD)

	Group A (n=12)	Group B (n=12)	Group C (n=12)
Age (yrs)	47.3±5.9	48.9±5.8	47.4±6.9
Height (cm)	163.2±11.2	165.3±11.9	163.6±10.3
Weight (kg)	65.2±10.0	66.2±10.5	64.5±10.2

*$p<0.05$, Group A = thoracic mobilization group; group B = thoracic manipulation group; group C = Control group

cient explanation of its purpose and methods was given and informed consent was obtained from all subjects. The study subjects provided written informed consent prior to participation according to the ethical standards of the Declaration of Helsinki (Table 1).

Methods

The Oswestry disability index (ODI) was used to measure the functional impairment of patients with LBP. The ODI is composed of 10 items, including pain level, private sterilization, gait, sitting, standing, sleeping, sexual life, social activities and travels. The sum of the scores is divided by the total score possible and then converted into a percentage. A higher score indicates higher functional impairment.

A multiple spinal diagnosis device was used to measure the range of motion (ROM) of vertebra segments. This device is used to measure the shape and mobility of vertebrae in the sagittal plane. Measurement was performed with hip/knee joint at 90 degrees of flexion, and subjects were instructed to maintain a neutral sitting position. The angle of vertebra flexion and extension was then measured in full active flexion and full active extension of the trunk. ROM measurements were repeated 3 times, and the mean value was used for statistical analysis.

The fear-avoidance beliefs questionnaire (FABQ) was used to investigate the mental state of LBP patients. This questionnaire consists of 16 items and is divided into two subareas, physical activity and work. Each item is scored from 0 to 6, and a high score demonstrates increased fear-avoidance beliefs.

Group A was provided with trunk mobilization after sling Neurac exercise, and group B was provided with trunk manipulation after sling Neurac exercise. Control group (group C) performed only sling Neurac exercise. Each intervention was conducted 3 times a week for 6 weeks, and all measurements were performed before and after the intervention.

Group A was instructed to lie in a prone position with the thorax slightly flexed, and then therapists applied grade 2–3 mobilization to the subjects. Anteriorly directed central gliding was applied to the segment with small movement of the facet joint after palpating T5–T12. Mobilization was performed for 60 seconds and repeated twice after confirming the comfort of the subjects during the procedure.

Group B was instructed to lie in a supine position with their upper limbs crossed, and then therapists put a hand on the vertebrae while the other hand supported the subject's neck. The therapist's hand was placed on the pain region by flexing the trunk using the subject's upper extremity, and looseness was eliminated by controlling the subject's breath during expiration. Thrust was performed vertically. Manipulation was performed just once on facet joints after palpating T5–T12.

Group C performed only sling Neurac exercise for 30 minutes. Traction-relaxation exercise was conducted for 5 minutes as a warm-up, and local muscle strengthening in a supine lumbar setting was applied for 10 seconds, with 5 repetitions for a total of 3 sets. Gross muscle strengthening in the form of the supine pelvic lift, side-lying hip abduction, and side-lying hip abduction was respectively performed for 10 seconds, with 5 repetitions for a total of 3 sets.

The result are shown as means±SD. PASW 18.0 for Windows was used for statistical analysis in this study, and homogeneity testing for general characteristics was performed using one-way ANOVA. To analyze the differences between before and after the interventions, the paired t-test was used. One-way ANOVA was also used to compare the differences between groups, and post-hoc analysis was conducted using the LSD test. The significance level was $\alpha=0.05$.

RESULTS

There was a significant change in ODI in all groups ($p<0.05$). There were significant differences between groups, and group A and B were significantly different from the control group in the post-hoc analysis. However, there was also a significant difference between group A and B (Table 2).

The changes in ROM were significantly different during trunk flexion and extension after the interventions in all groups (Table2). Between groups, there was no difference in ROM during trunk flexion. However, group A was significantly different from the control group in the LSD post-hoc analysis. ROM during trunk extension was significantly different between groups, and groups A and B were significantly different from the control group in the LSD post-hoc analysis. However, there was no statistically significant difference between groups A and B ($p>0.05$). There was a significant change in FABQ only in group B. There were significant differences in the LSD post hoc analysis between groups, and B group was significantly different from the control group (Table 2).

DISCUSSION

Most people experience lower back pain in their life-

Table 2. Comparison of KODI, ROM, and FABQ among the groups (mean±SD)

		Group A (n=12)	Group B (n=12)	Group C (n=12)
KODI* (%)	Pre-test	72.6±8.3	72.4±8.3	67.2±7.9
	Post-test	34.5±13.6	33.6±12.8	47.7±12.2
Flexion (◦)	Pre-test	72.8±6.2	73.9±8.5	72.7±7.5
	Post-test	83.5±8.2	87.2±7.9	81.5±8.2
Extension* (◦)	Pre-test	20.6±5.9	20.2±5.3	19.2±6.3
	Post-test	25.4±7.8	30.2±6.4	25.5±7.2
FABQ (score)	Pre-test	72.2±5.3	73.6±7.3	73.1±6.8
	Post-test	81.4±6.4	87.9±4.2	81.8±5.5

*p<0.05, Group A = thoracic mobilization group; group B = thoracic manipulation group; group C = Control group

times, and it is one of the highly recurring diseases. LBP patients suffer from pain, a decrease in endurance and flexibility, and limited ROM of the lumbar region. Furthermore, LBP patients have a lower balance ability, resulting in some difficulties in activities of daily living (ADL)[7, 8].

In previous studies, instability of the lumbar region was introduced as the most important cause of lower back pain out of many factors[9, 10]. Active exercise and manipulation therapy are widely used to improve lumbar function and prevent recurrence[11]. Lumbar stabilization exercise is clinically applied to treat lumbar instability. In addition, a therapeutic approach has already been introduced that can reduce the stress on the lumbar region by applying joint mobility therapy to the segments with lesser movement. That is, therapy including manipulation is a more effective approach because exercise for the vertebrae alone would not resolve lower back pain[12].

In this study, the ODI was significantly decreased in all groups after intervention, and the ODIs of groups A and B were more significantly decreased than that of the control group. Ko[13] reported that in his study comparing a mobilization group with a William exercise group, the ODI of the mobilization group was more significantly decreased compared with that of the William exercise group. This indicates that when thoracic mobilization is combined with lumbar exercise, the therapy becomes more effective.

Deep muscles in the lumbar region of LBP patients are weaker than those of healthy adults and reposition sense is decreased by reduced proprioception, resulting in instability of vertebrae. Furthermore, vertebra movement becomes abnormal during flexion and extension of the trunk, and abnormal coupling motion also occurs during lateral flexion of the trunk. The more severe the spasticity of the thorax is, the more excessive movement in the cervical and thoracic regions occurs[14].

In this study, the ROMs of flexion and extension were significantly increased in all groups. Between groups, there was a significant difference only in the ROM of trunk extension. The post-hoc analysis revealed that group A and B showed significant increases compared with group C. Heo reported that an increase in thoracic mobility improved the stability of the lumbar region by reducing the compensation movements in the lumbar region, resulting in decreased pain and physical impairment[15]. Furthermore, Kaltenborn reported lumbar stability could be improved by relative control of segment movement[16].

Psychological factors are focused on as the cause of pain and chronicization related to the musculoskeletal system. Fear-avoidance belief, one of the psychological factors, is an activity in which patients avoid a movement because of fear of pain, and this can cause the disease to become chronic and aggravate the physical symptoms. The existence of fear-avoidance belief in chronic LBP patients should be considered, because it is helpful to anticipate the results of therapy and prognosis of patients performing ADL[17, 18].

In this study, there was a significant decrease in FABQ only in B group. Between groups, there was a statistically significant difference, and group B was more significantly decreased than the control group. It is thought that reduction of pain and improvement of ROM after thoracic manipulation would affect the patient's mental state.

Based on our findings, lumbar stabilization could be improved by thoracic mobilization and thoracic manipulation, improving thoracic mobility. However, all measurements were not significantly different between the mobilization group and manipulation group. Thus, when lumbar stabilization exercise is combined with thoracic manual therapy, the increase in ODI, FABQ, and ROM of trunk extension would be enhanced. Continuous application will be needed, and treatment programs including interventions that can improve thoracic mobility are expected to be widely used.

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