The Influence of Lumbar Joint Mobilization on Joint Position Sense in Normal Adults

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Abstract. [Purpose] The purpose of this study was to determine the effects of lumbar joint mobilization on the joint position sense (JPS) of normal adults. [Subjects] A total of 30 normal adults were divided into an experimental group (n = 15) and a control group (n = 15). [Methods] The experimental group received lumbar joint mobilization and massage, and the control group received massage only. Both the experimental and control groups were evaluated for joint position error (JPE) by using a digital dual inclinometer before and after the experiment. [Results] In the before and after comparison for the experimental group, statistically significant differences were found in flexion, extension, left lateral flexion, and right lateral flexion. There was no statistically significant difference in the before and after comparison for the control group. [Conclusion] Because lumbar joint mobilization can reduce JPE and improve JPS, its use in the treatment of patients with lumbar problems is recommended.

Key words: Gong’s mobilization, Joint position sense, Joint position error

INTRODUCTION

Intact proprioception is a basic element in controlling movement1), and joint position sense (JPS) is an important body function for recognizing the position of the joints and an essential factor in maintaining balance or kinesthesia3). JPS in the spine is provided by the spinal ligaments, facet joints, and intervertebral discs3), and much more stimulation is given to the end range of joint positions4). The proprioceptive information originating from the muscle and joint receptors is an important factor in trunk control5). Soft tissue injuries such as anterior cruciate ligament deficiency, ankle sprains, glenohumeral instability, neck injury, and low back pain cause joint position error (JPE)6–8).

A previous study on JPS investigated the relation between lumbar spinal motion and facet joint capsule strain9). Another previous study reported that JPS is higher in persons with back dysfunction and discogenic back dysfunction than in normal persons10). Muscle vibration reportedly increases proprioception and enhances local muscle control11), and athletes with back pain have a lower lumbar position sense12). Another similar study investigated the effects of cervical joint manipulation on JPS in normal adults13), and many rehabilitation programs for athletes have emphasized proprioception training because impaired JPE is a major cause of recurrent injuries14).

However, whereas most of these studies identified the relation between back pain and JPS, improved JPS through exercise, or identified the effects of cervical joint mobilization on JPS, studies on the effects of lumbar joint mobilization on the lumbar JPS of normal adults are rare. Therefore, we aimed to study this effect.

SUBJECTS AND METHODS

The subjects of this study were 30 students attending N University, Republic of Korea. They were divided into the experimental group (n = 15; 1 male and 14 females) and the control group (n = 15; 1 male and 14 females). The age, height, and weight of the experimental group were 22.9±0.2 years, 162.3±5.9 cm, and 56.2±6.0 kg, respectively. The age, height, and weight of the experimental group were 22.0±0.3 years, 163.2±4.9 cm, and 55.1±8.5 kg, respectively. There was no significant statistical difference between the 2 groups (p>0.05). All subjects were adults in their 20s, and those with a history of surgery, those undergoing treatment, and those with lumbar disc hernia were excluded from the study. This study was approved by Korea Nazarene University’s institutional review board, and the safety of the subjects was protected during all experimental processes. All of the subjects understood the purpose of this study and provided written informed consent before participation, in accordance with the ethical standards of the Declaration of Helsinki.

The experimental group received lumbar joint mobilization by using Gong’s mobilization technique for 10 min and a massage for 15 min. For lateral flexion during lumbar joint mobilization, the subjects sat astride the edge of a treatment bed in a position similar to that in horse riding with both...
and RLF (p<0.05) were statistically different between be-
JPE, the lower the JPS capability. JPE was measured by us-
fore and after the intervention, whereas no statistical sig-
at 0.05.

The experimental results were statistically analyzed by
using a digital dual inclinometer (Dueler IQ; JTECH Medical,
Salt Lake City, UT, USA). After the subjects were trained
2 times before and after the experiment, and the average
value was used in the analysis.

The experimental results were statistically analyzed by
using SPSS 12.0 KO (SPSS, Chicago, IL, USA). After the
general characteristics of the subjects were determined, a
paired t-test was used to compare changes in Fle, Ext, LLF,
and RLF before and after the test in each group. The differences
between the 2 groups were tested by using an inde-
pendent t-test. The statistical significance level, α, was set
at 0.05.

**RESULTS**

In the experimental group, the extents of Ext, LLF,
and RLF (p<0.05) were statistically different between be-
fore and after the intervention, whereas no statistical sig-
ificance was found in the control group in all categories
(p>0.05) (Table 1). In the results of the independent t-test
for Fle, Ext, LLF, and RLF in the 2 groups (before the ex-
periment, after the experiment, or the difference between
before and after the experiment), there were statistically
significant differences in the post-experiment values for
Fle, Ext, and LLF and in the differences between the pre-
and post-experiment values for Ext (p<0.05), whereas no statistically significant differences were found in other cat-
egories (p>0.05) (Table 2).

**DISCUSSION**

Lumbar facet joints serve mechanical and mechano-
sensory functions in the spine. In addition, when a lumbar
spinal motion occurs, the intervertebral angle and lumbar
facet joint capsule strain increase at the same time. The cap-
sole of the facet joint is involved not only in joint stability
through movement but also in pain and proprioception 9).

Therefore, increasing the ROM of the capsule of the facet
joint is thought to improve JPS by enhancing the proprio-
ception function. In this study, we investigated the effects
of lumbar joint mobilization on the JPS of normal adults.

In a lumbar joint mobilization-related study, Gong re-
ported an increase in the lumbar extension range of motion
after applying Gong’s mobilization to a patient with low
back pain 15). Konstantinou et al. applied the joint mobiliza-
tion technique to 26 patients with lumbar pain and reported
that the lumbar extension ROM significantly increased in
the group that received the joint mobilization technique 16).
Other previous studies also reported that application of the
joint mobilization technique increased the lumbar extension
ROM 17, 18).

In the pre- and post-experiment comparison performed
in this study, the change in JPE (Ext, LLF, and RLF) of the
subjects who received Gong’s mobilization, was statistical-
ly significant. In the independent t-test performed for com-
parisons of pre-experiment values, post-experiment values,
and the differences between pre- and post-experiment val-
ues was 0.20±1.56

| Category | Pre-test | Post-test | Difference between the pre- and post-test values |
|----------|----------|-----------|-----------------------------------------------|
| Fle      | 2.06±0.96| 2.06±0.96 |                                    |
| Ext*     | 2.00±1.30| 1.60±1.29 |                                    |
| LLF*     | 1.73±1.03| 1.53±1.35 |                                    |
| RLF      | 1.60±1.29| 1.53±1.35 |                                    |

* p<0.05, mean±SD

**Table 2. Comparison of lumbar joint position error between the experiment group and control group (unit: degree)**

| Category | Experiment group | Control group |
|----------|------------------|---------------|
| Fle      | 1.93±1.27        | 1.73±1.29     |
| Ext*     | 2.00±1.30        | 1.60±1.29     |
| LLF*     | 1.73±1.03        | 1.53±1.35     |
| RLF      | 1.60±1.29        | 1.53±1.35     |
| Fle*     | 0.73±0.70        | 1.53±0.91     |
| Ext*     | 0.80±0.94        | 1.53±0.99     |
| LLF*     | 0.66±0.81        | 1.46±1.39     |
| RLF      | 0.80±0.94        | 1.66±1.39     |
| Fle      | 1.20±1.56        | 0.20±1.56     |
| Ext*     | 1.26±0.96        | 0.06±1.79     |
| LLF      | 1.06±1.43        | 0.06±1.48     |
| RLF      | 1.20±1.37        | 0.06±2.08     |

* p<0.05, mean±SD

**Table 1. Comparison of the pre- and post-test lumbar joint position errors in each group (unit: degree)**

| Group    | Category | Pre-test | Post-test |
|----------|----------|----------|-----------|
| Experiment group | Fle      | 1.93±1.27| 0.73±0.70 |
|          | Ext*     | 2.06±0.96| 0.80±0.94 |
|          | LLF*     | 1.73±1.03| 0.66±0.81 |
|          | RLF*     | 2.00±1.30| 0.80±0.94 |
|          | Fle      | 1.73±1.29| 1.53±0.91 |
| Control group | Ext      | 1.60±1.24| 1.53±0.99 |
|          | LLF      | 1.53±1.35| 1.46±0.99 |
|          | RLF      | 1.60±1.29| 1.66±1.39 |

* p<0.05, mean±SD

legs apart (the back and hip at that time were oriented to-
toward the direction of the edge of the bed). The hands were
crossed and placed on the shoulders, with the therapist posi-
tioned by the side of the subject. One hand of the therapist
made contact with the lower vertebral laminae of the joint
to be mobilized, and the other hand made contact with the
opposite side of the trunk, after which lateral flexion was
induced to the coronal plane with respect to the Z-axis, and
a short and rapid thrust was applied from the end range.
With this method, all 5 joints on the left and right sides of
the lumbar spine were mobilized 15). A similar method was
applied to the extension range of motion (ROM) 15). Massage
was performed on the erector spinae, quadrates lumborum,
and latissimus dorsi muscles. The control group received
only 1 massage for 15 min 15).

JPS was evaluated from the JPE; that is, the higher the
JPE, the lower the JPS capability. JPE was measured by us-
ing a digital dual inclinometer (Dueler IQ; JTECH Medical,
Salt Lake City, UT, USA). After the subjects were trained
times to locate certain positions precisely (lumbar flexion
[Fle] 35°, extension [Ext] 35°, left lateral flexion [LLF]
30°, right lateral flexion [RLF] 30°) with passive lumbar
movement under the guidance of the evaluator in a neu-
tral position, they were asked to locate with active lumbar
movement the positions in the 4 directions by themselves,
without the guidance of the evaluator. The difference be-
tween the 2 procedures was recorded; JPE was measured
3 times before and after the experiment, and the average
value was used in the analysis.

The experimental results were statistically analyzed by
using SPSS 12.0 KO (SPSS, Chicago, IL, USA). After the
general characteristics of the subjects were determined, a
paired t-test was used to compare changes in Fle, Ext, LLF,
and RLF before and after the test in each group. The differences
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**RESULTS**

In the experimental group, the extents of Ext, LLF,
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fore and after the intervention, whereas no statistical sig-
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(p>0.05) (Table 1). In the results of the independent t-test
for Fle, Ext, LLF, and RLF in the 2 groups (before the ex-
periment, after the experiment, or the difference between
before and after the experiment), there were statistically
significant differences in the post-experiment values for
Fle, Ext, and LLF and in the differences between the pre-
and post-experiment values for Ext (p<0.05), whereas no statistically significant differences were found in other cat-
egories (p>0.05) (Table 2).
In a similar study, Gong divided 30 normal adults into a cervical joint manipulation group (n = 15) and a massage group (n = 15) and reported that cervical joint manipulation decreased JPE and improved JPS. The results of Gong’s study are similar to those of this study, except for the difference in position (cervix vs. lumbar)\(^1\). Simon et al. applied vibration to the paraspinal muscle in 23 young patients with low back pain and 21 control subjects and measured the lumbosacral position sense; they reported that the repositioning accuracy was significantly lower in the patient group than in healthy persons. While mechanoreceptors in deep muscles were mainly stimulated in their study, in another current study, mainly those in the joint capsule were stimulated\(^1\). Georgy divided 45 participants into a back dysfunction group (n = 15), discogenic back dysfunction group (n = 15), and control group (n = 15) and measured JPE after performing a target position of 30° lumbar flexion. Compared with the control group, the JPEs of the back dysfunction group and discogenic back dysfunction group were reportedly higher\(^1\).

The JPE of the group that received lumbar joint mobilization in this study decreased compared with the group that received massage only. This result is similar to a previous study that showed that joint mobilization improves JPS\(^1\). Mobility in each segment is generated by joint mobilization, and joint mobilization activates proprioceptors in the joint capsule and deep muscle, which is thought to lead to improvement in JPS. Therefore, we recommend the application of lumbar joint mobilization to improve motion capability in subjects with diminished JPS due to a reduced ROM or in patients with back dysfunction.

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