

# The effects of stabilization exercise with an oral assistive device on pain and functionality of low back pain patients

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**Abstract.** [Purpose] This study examined low back pain patients' decrease in pain and improvement in functionality after performance of a lumbar stabilization exercise using an oral assistive device, which can replace a lumbar assistive device. [Subjects and Methods] The experimental group (n=12) conducted a stabilization exercise using an oral assistive device after conventional physical therapy. The control group (n=12) received conventional physical therapy. In order to objectively measure pain in this study, a visual analogue scale (VAS) was used. In order to evaluate the subjects' functional aspects while living with low back pain, the Oswestry Disability Index (ODI) was used. [Results] There were statistically significant improvements in the comparison of the VAS and ODI of the experimental group and the control group. The experimental group's VAS and ODI significantly improved after the intervention compared to the control group. [Conclusion] The stabilization exercise using the assistive device after conventional physical therapy in the rehabilitation of low back pain patients reduced subjects' pain and increased their functional activities.

**Key words:** Pain, LBP, Stabilization exercise

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## INTRODUCTION

Low back pain is one of the most costly diseases and it occurs very frequently in modern society. Sixty to eighty percent of the population experience low back pain at least once in their lifetime and most of them are treated successfully. However, 5 to 15% of patients suffer continuous pain without full relief from treatment. Low back pain refers to all kinds of pain occurring in the lumbar region, and those in their 20s to 50s suffer the most from low back pain, and it persists for a long time with those who are aged<sup>1)</sup>.

The most important symptom of low back pain patients is pain. Pain is a complex and multi-faceted phenomenon which is a unique individual experience that is difficult for patients to explain or describe, and therefore it is not easy for others to recognize, understand, or correct. Pain is defined as responses which protect the body from painful sensations, harmful stimuli that inform about damage to the tissues, or imminent tissue damage or harm. For lumbar pain patients, the management of pain is considered more important than

other elements and is the purpose for treatment<sup>2)</sup>.

The causes of low back pain are diverse. It is affected by many aspects in the physical, social, and psychological domains. It may be caused by lesions or trauma of the spinal cord or the area around it, degenerative changes in an intervertebral disc, abnormality in the internal organs, or psychoneural problems. The symptoms of low back pain include sensory anomaly, radiating pain in the lower extremities, pain during rest or exercise, a decrease in muscle strength or range of motion, and asymmetry between the left and the right sides<sup>3)</sup>. In addition, the transversus abdominis and multifidus muscles of chronic low back pain patients are activated later than those of healthy people, have slower response speeds, and undergo more serious atrophy than other muscles. Atrophy of the trunk muscles, such as the internal oblique, external oblique, transversus abdominis, and multifidus, makes the lumbar spine and the pelvis unstable and is known to be a major cause of chronic pain<sup>4)</sup>.

Lumbar stabilization exercises increase the stability of the spine and pelvis during functional positions and movements, restore the adjustment ability of the muscles as well as movement and balance, and improves the trunk and the deep muscles, promoting health, and is used in rehabilitation exercises for patients and training exercises for athletes<sup>5)</sup>. However, lumbar stabilization exercises need a visit to a hospital and the instruction and assistance of a therapist, and it is difficult for patients to conduct stabilization exercises themselves. In order to address these limitations, patients'

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use of assistive devices during ordinary life is currently on the rise.

The use of an assistive device is an essential element of a disabled person's activities of daily living and social activities, and is a crucial means of maintaining the disabled person's physical functions<sup>6)</sup>. For low back pain patients, assistive devices that provide stability to the lumbar region by pressing the lumbar spine and the pelvic area are widely used. However, lumbar assistive devices are mostly worn over clothing and are visible to others, which most patients do not like, and wearing an assistive device incorrectly for a long time may lead to little or no use of the muscles around the lumbar spine, leading to muscle atrophy. Accordingly, this study examined the effect on low back pain patients' pain and functionality of a lumbar stabilization exercise performed with an oral assistive device, which can replace a lumbar assistive device.

## SUBJECTS AND METHODS

### *Subjects*

The subjects of this study were patients who had been diagnosed with chronic pain and had been hospitalized or had visited a hospital for physical therapy. They were able to answer the questionnaire and understood the purpose of this study. The total number of subjects was 24. The experimental group (n=12) performed a stabilization exercise using an oral assistive device after conventional physical therapy. The control group (n=12) received conventional physical therapy: a hot pack for 20 minutes, ultrasound treatment for 5 minutes, and low frequency TENS treatment for 20 minutes. The experimental group performed exercise using an assistive device 3 times per week for 4 weeks, a total of 12 times. Evaluations of the patients' pain and functionality were conducted prior to the experiment and after the last exercise session.

Patients with the following conditions were excluded: acute and sub-acute states of low back pain within three months after low back pain occurrence; hypertension; angina pectoris; neurological diseases, such as stroke or Parkinson's disease; cognitive or psychiatric disorders; spinal fractures or tumors; knee arthritis surgery and complex diseases other than low back pain. All the subjects understood the purpose of this study and provided their written informed consent prior to their participation, in accordance with the ethical principles of the Declaration of Helsinki (Table 1).

### *Methods*

In order to objectively measure pain in this study, a visual analog scale (VAS) was used. The reliability of the VAS has been reported to be 0.89. The VAS was made from a scale with a height of 5 mm and a length of 100 mm. Zero on the scale indicates a pain-free condition, and the most severe pain imaginable is scored as 100. In order to evaluate the subjects' functional aspects while living with low back pain, the Oswestry Disability Index (ODI) was used. The ODI is composed of 10 items related to each activity of daily living and its reliability has been reported to be 0.92. It consists of six rating levels from zero to five points, and the total score is divided by the number of items answered and multiplied

by 100. The lower the score, the smaller the functional disability of the lumbar region.

The subjects performed a stabilization exercise using an oral assistive device (Selfface22, G&G Beauty+, Korea). To use Selfface22, the subjects were asked to lock their fingers together naturally, and the hand whose thumb was located above the other thumb was identified. When the left thumb was above, the letters A and B on the product were positioned on the left side and the subjects held it in their mouths. When the right hand was above, the alphabet of the product A and B were situated on the right side and the subject held it with the mouth. The locations of the lips and mouth were corrected for the precise application of Selfface22 according to the location of the thumb.

The subjects lay in a supine position, with Selfface22 in the mouth. The upper teeth were fixed with the fingers and the product was softly bitten with the lower teeth. Pressing their lips together and closing their mouths, the subjects gripped the Selfface22 and were instructed to block the hole in the middle of the product with their tongues and suck it. The subjects sucked it as hard as possible and held their breath for 10 seconds, breathed out, and rested for 10 seconds. In addition, in order to promote thoracic respiration, when they sucked the product as hard as possible, they were instructed to suck the product while raising their chests upward. The patients performed 30 trials, with 10 trials in one set, resting for three minutes between each set. To ensure the proper use of the Selfface22 and the stabilization exercise, the exercise was conducted under the supervision of the therapist for the first week. When a subject incorrectly performed the exercise or compensation in another area occurred, instruction and retraining were given. Subjects who complained of dizziness because of a rise in blood pressure rested for 10 minutes and then continued performing the exercise.

For the data analysis, descriptive statistics were used to examine the general characteristics of the subjects and their values are expressed as means±standard deviation. The paired t-test was conducted in order to compare the pre- and post-test results of each group. The independent t-test was carried out on the differences between the pre-test values and the post-test values in order to compare the treatment effects between the groups. The statistical analysis was conducted using SPSS 20.0, and significance was accepted for values of  $p < 0.05$ .

## RESULTS

There was a statistically significant difference in the VAS of the experimental group between before and after the treatment ( $p < 0.05$ ). In addition, there was a significant difference between before and after the experiment in the disability index evaluation of the experimental group ( $p < 0.05$ ) (Table 2). There was a significant difference in the VAS of the control group between before and after the treatment ( $p < 0.05$ ). In addition, there was a significant difference in the disability index evaluation of the control group between before and after the experiment ( $p < 0.05$ ) (Table 3). There were statistically significant differences between the changes in VAS and ODI of the experimental group and the control group ( $p < 0.05$ ). The experimental group's VAS and ODI sig-

**Table 1.** General characteristics of subjects (Mean±SD)

	Experimental group (n=12)	Control group (n=12)
Age (yrs)	58.2±5.2	59.6±6.6
Height (cm)	154.5±8.6	153.3±9.6
Weight (kg)	53.9±5.9	54.3±5.5

**Table 3.** Comparison of VAS, ODI between pre-test and post-test in the control group (Mean±SD)

	Pre-test (n=12)	Post-test (n=12)
VAS*	75.3±5.4	46.7±5.5
ODI*	6.9±0.6	3.6±0.7

\*p<0.05, VAS: Visual analog scale, ODI: Oswestry disability index

**Table 2.** Comparison of VAS, ODI between pre-test and post-test in the experimental group (Mean±SD)

	Pre-test (n=12)	Post-test (n=12)
VAS*	72.2±3.8	34.2±3.2
ODI*	6.7±0.8	2.2±0.6

\*p<0.05, VAS: Visual analog scale, ODI: Oswestry disability index

**Table 4.** Comparison of VAS, ODI between the groups (Mean±SD)

	Experimental group (n=12)	Control group (n=12)
VAS*	38.5±5.3	29.4±9.5
ODI*	4.5±1.2	3.3±1.0

\*p<0.05, VAS: Visual analog scale, ODI: Oswestry disability index

nificantly improved after the intervention compared to the control group (p<0.05) (Table 4).

## DISCUSSION

Low back pain is a representative disease that necessarily occurs because humans walk upright and is the most common cause of labor loss among the chronic diseases. Excessive mechanical burden on the spinal structure acts as an essential cause of low back pain. As a result, many symptoms occur, including weakened muscle strength, imbalances in muscle strength, articular instability, pain, decreases in the ability to perform activities of daily living, and gait disorder. Low back pain triggers psychological problems, such as anxiety, depression, and lack of confidence, and may also cause alcohol or drug dependency, as well as physical symptoms resulting from a decrease in the ability to remain active due to muscle atrophy while avoiding physical activities<sup>1</sup>.

During the acute and sub-acute phases of low back pain, surgical operations and drug treatments are effective at alleviating pain, but in the case of chronic low back pain, these methods temporarily alleviate pain but do not resolve the fundamental causes. Therefore, exercise therapy to strengthen the muscles and ligaments around the lumbosacral area is largely used. The purposes of exercise therapy for low back pain include strengthening weakened muscles, correcting asymmetric muscle strength imbalance, extending shortened muscles or ligaments, decreasing increased lumbar lordosis, and increasing the flexibility of the stiffened lumbar region<sup>3</sup>. Many diverse exercise therapies are used to treat low back pain. Among them, exercise therapy to alleviate low back pain, pelvic inclination exercises, muscle strengthening exercises, flexibility improving exercises, endurance increasing exercises, and lumbar region stabilization exercises are important<sup>7</sup>.

For the treatment of low back pain, in general, an appropriate assistive device should be worn during exercise treatment to maintain the body's flexibility and muscle strength. At present, in the clinical field, spinal assistive devices are used to improve pelvic stability and the ability to perform

activities of daily living. A spinal assistive device diffuses the weight of the upper body concentrated on the lumbar region, decreases low back pain, and reduces segmentation movement and the degree of lordosis, thereby stabilizing the lumbosacral area<sup>6, 8</sup>.

This study examined the effects of a stabilization exercise using an oral assistive device on low back pain patients' pain and functionality. After the stabilization exercise using the assistive device, the experimental group's VAS and ODI showed statistically significant improvements compared to before the experiment: the pain and disability indexes significantly decreased after the intervention due to improvements in stability and balance ability mediated by better alignment of the lumbar region and the subjects' coordination ability as a result of using the oral assistive device. Zissimopoulos et al. examined the effects of an assistive device on the balance of chronic stroke patients and found a statistically significant improvement in the experimental group's balance ability due to the use of an assistive device<sup>9</sup>.

In the present study, there were treatment-related statistically significant differences in VAS and ODI between the experimental group and the control group, and the changes in VAS and ODI were significantly greater in the experimental group, which conducted a stabilization exercise with the assistive device, than in the control group. In other words, a stabilization exercise using an assistive device after ordinary physical therapy in the rehabilitation of low back pain patients decreased subjects' pain and increased their functional activities.

This study involved a small number of subjects and its intervention period of four weeks was short. In addition, this study did not classify patients according to the causes of low back pain; therefore, it is difficult to generalize its results. Further, during the intervention period, drug therapy and injection therapy for pain and inflammation treatment were not controlled. In a future study, the author is planning to compare different treatment methods and experimental results after classifying the patients according to the causes

of low back pain or the stages of low back pain, and a long-term intervention period.

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