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# Effectiveness of Lumbar Stabilization Exercises for Reducing Chronic Low Back Pain and Improving Quality-of-Life

MEGUMI OTA, MS[1,2], KOJI KANEOKA, MD[3], MIKA HANGAI, MD[3],
KEISUKE KOIZUMI, MS[5], TOSHIKI MURAMATSU, MD[3]

[1]*Graduate School of Sport Sciences, Waseda University: 2–579–15 Mikashima, Tokorozawa-shi, Saitama-ken, 359-1192 Japan. TEL & FAX: +81 42-947-6958, E-mail: meg.oht@akane.waseda.jp*
[2]*Tokyo Eisei Gkakuen College*
[3]*Faculty of Sport Sciences, Waseda University*
[4]*Showa General Hospital*
[5]*Japan Institute of Sports Science*

**Abstract.** [Purpose] Therapeutic exercise for chronic low back pain is one of the most important conservative treatments. Recently, lumbar stabilization exercise focused on deep trunk muscles has attracted considerable attention. This study investigated the effectiveness of lumbar stabilization exercises for treating CLBP. [Subjects] The subjects were 18 patients with CLBP. CLBP was defined as pain that persisted for more than 3 months. [Methods] The therapeutic exercises involved the abdominal drawing-in maneuver (hereafter referred to as "drawing-in") and prone kneeling (hereafter referred to as "hand-knee"). The exercises were performed during a 3-month intervention period. Pain was evaluated using a Visual Analog Scale (hereafter referred to as "VAS"), while quality-of-life (hereafter referred to as "QOL") was estimated using the Japanese Orthopaedic Association Back Pain Examination Questionnaire (hereafter referred to as "JOABPEQ"). Pain and QOL were assessed prior to the intervention (T0), and at one (T1), three (T3), and six months (T6) after the intervention. The Steel-Dwass test was used to investigate differences between values prior to and after performance of the therapeutic exercise regime. Significance was defined as $p<0.05$. [Results] The median low back pain value was significantly improved at T3 and T6 compared to T0. At T1, patients reported significant improvement in the lumbar functions score in comparison with T0. This change was still observed at T3 and T6. At T3, scores of all items had significantly increased. At T6, the changes in low back pain score and walking ability score were no longer significant, however their tendencies remained. [Conclusions] These results suggest that performance of lumbar stabilization exercises is an effective method for improving comfort and QOL of patients with CLBP.
**Key words:** Low back pain, Therapeutic exercise, QOL

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## INTRODUCTION

Many studies have examined the effectiveness of therapeutic exercises performed by patients with CLBP[1–12]. McKenzie exercises that extend the lumbar vertebrae and Williams exercises that flex the lumbar vertebrae are representative therapeutic exercises for patients with CLBP. Recently, lumbar stabilization exercise focused on deep trunk muscles has attracted considerable attention[9–12]. Prior studies have proposed that posture maintenance muscles act ahead of prime mover muscles and have confirmed this to be the case in voluntary movements of upper or lower limbs in healthy individuals[13–15]. This process is called anticipatory postural adjustment (hereafter referred to as "APA"), and it allows healthy individuals to maintain their postures while compensating for voluntary movements[16]. In addition, deep trunk muscles, such as the transverse abdominal and multifidus muscles play important roles as agonists of limb movement[14,15]. However, it is reported that activities of the deep trunk muscles attenuate in patients with LBP delays participation[17–19].

The abdominal drawing-in maneuver and hand-knee facilitate activation of the transverse abdominal muscle and lumbar multifidus muscles in stabilization of the trunk[20–24]. These maneuvers are often part of therapeutic routines for strengthening deep trunk muscles in patients with CLBP, and they are thought to be primary factors behind the efficacy of these exercises[9,25]. These exercises do not need special appliances or facilities, and can easily be performed at home.

We examined whether a simplified therapeutic routine, consisting only of drawing-in and hand-knee, could

decrease pain and improve QOL in patients with LBP.

## SUBJECTS AND METHODS

We examined a total of 18 patients (4 men and 14 women; average age: 54.1 yrs) with CLBP, defined as low back pain lasting over three months. Patients were excluded from the study if the pain was determined to originate from internal organs, or if they had spondylitis, spinal cord tumors, or paralysis of the lumbar vertebrae. Prior to the study, all patients provided their written informed consent.

At the beginning of the study, patients received individual instructions on how to perform the drawing-in and hand-knee exercises. The drawing-in is achieved by subjects pulling the abdomen in, without allowing significant lumbar motion. The holding time and the number of contractions were 10 seconds × 10 times per set. The hand-knee is performed by subjects raising one of the upper limb and the contralateral lower limb to the horizontal position, holding, and the returning to prone kneeling. The holding time and then the number of contractions were 5 seconds × 10 times per set. The subjects were asked to continue these maneuvers on a daily basis during over a three month training period. After one month of the intervention, we once again educated the subjects and individually adjusted the exercise intensity. Patients were instructed to cease the exercises if they a ill or suffered from injury.

In addition to evaluating low back pain, we also evaluated lumbar-related pain and numbness in the buttocks and legs. Pain and numbness were evaluated using a VAS, and QOL was estimated using JOABPEQ. JOABPEQ is a questionnaire comprising of five items: low back pain, lumbar function, walking ability, social life function, and mental health. We asked each subject about the degree of their pain or numbness and QOL when their symptoms were at their worst during the last week. Pain and QOL were assessed prior to the intervention (T0), and at one (T1), three (T3), and six (T6) months after the intervention. The Steel-Dwass test was used to investigate differences between values prior to and after performance of the therapeutic exercise regime. Significance was defined as $p<0.05$.

## RESULTS

Prior to the intervention, the median low back pain value was 49.0 mm (range: 0 to 90.0). This steadily fell over the study period to 23.0 mm (range: 0 to 83.0) at T1, 15.5 mm (range: 0 to 48.0) at T3, and 6.0 mm (range: 0 to 72.0) at T6 (Table 1). Low back pain decreased significantly after T3 ($p<0.05$). Although the changes in pain and numbness in the buttocks and legs were not significant, their values steadily decreased throughout the study period (Table 1).

**Table 1.** Comparison of pain and numbness experienced prior to and after the intervention.

| VAS (mm) | Low back pain | Buttock /leg pain | Buttock /leg numbness |
|---|---|---|---|
| T0 | 49 (0–90.0) | 34.5 (0–10.0) | 9.5 (0–10.0) |
| T1 | 23 (0–83.0) | 10.5 (0–80.0) | 35 (0–100.0) |
| T3 | 15.5 (0–48.0)* | 1 (0–100.0) | 40 (0–100.0) |
| T6 | 6 (0–72.0)* | 0 (0–75.0) | 0 (0–100.0) |

* $p<0.05$ compared with T0. T0: pre-intervention; T1: 1 month after the start of intervention; T3: 3 months after the start of intervention; T6: 6 months after the start of intervention

Several aspects of QOL were altered by performance of the therapeutic exercises (Table 2). At T1, patients reported significant improvement in the lumbar functions score in comparison with T0. This change was still observed at T3 and T6. At T3, scores of all items had significantly increased. At T6, the changes in low back pain score and walking ability score were no longer significant, however their tendencies remained.

## DISCUSSION

We found that patients with CLBP could decrease their discomfort and improve their QOL by performing two simple therapeutic exercises (drawing-in, hand-knee) at home for three months.

Rasmussen-Barr E et al.[9] compared the effects of stabilization exercises in which patients were taught the biology behind the structure and function of the backbone, lumbar stabilization, and the recurrence of LBP. The treatment period was 8 weeks. The outcome measures were perceived pain, disability, physical health, fear-avoidance

**Table 2.** Comparison of QOL experienced prior to and after the intervention

| JOABPEQ (point) | Low back pain | Lumbar function | Walking ability | Social life function | Mental health |
|---|---|---|---|---|---|
| T0 | 71 (0–100) | 62.5 (17–100) | 86 (0–100) | 61 (3–100) | 52.5 (39–75) |
| T1 | 100 (43–100) | 100 (58–100)* | 100 (29–100) | 86 (38–100) | 66 (42–89) |
| T3 | 100* (14–100) | 100 (58–100)* | 100 (43–100)* | 100* (57–100) | 69.6* (45–96) |
| T6 | 100 (29–100) | 100 (50–100)* | 100 (50–100) | 100* (65–100) | 77* (33–96) |

* $p<0.05$ compared with T0. T0: pre-intervention; T1: 1 month after the start of intervention; T3: 3 months after the start of intervention; T6: 6 months after the start of intervention

and self-efficacy beliefs at 12 months follow-up. Patients who performed stabilization exercises experienced significant improvements in pain, disability, physical health and self-efficacy belief.

In our study, we showed that CLBP patients who performed therapeutic exercises for improving lumbar stabilization experienced decreases in pain and increases in QOL. Deep trunk muscles such as the transverse abdominal and multifidus muscles are involved in the stabilization of the spine[14,15]. Because the exercises increase the activity of the transversus abdominis and multifidus muscles[20–24], we suggest the deep trunk muscle function of the subjects in this study were improved.

In this study, despite the low intervention frequency of physical therapists, the results were similar to those of previous studies. For many patients, frequent commutes to/from hospital are prohibitively expensive. Our results show that pain can be reduced and QOL can be increased by simple therapeutic exercises that can be performed at home after only a brief instruction period. However, in a study examining the effectiveness of a lumbar stabilization exercise performed for one month[25], the degree of pain was significantly reduced compared with before intervention, and four of 5 QOL scores were significantly improved after the intervention, but the low back pain score of JOABPEQ did not change significantly. In future, we will need to consider how to continue the exercises in the home.

This study had some limitations. For instance, we did not include a control group. In addition, because there were few subjects, the analysis lacks statistical power. Regardless of this, because of the robustness of our results, we feel confident recommending this cost-effective therapeutic method for future clinical use.

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