Can standing back extension exercise improve or prevent low back pain in Japanese care workers?

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Background: We suggested a standing back extension exercise 'One Stretch' based on the McKenzie method, to examine the ability to improve or prevent low back pain (LBP) in Japanese care workers.

Methods: We conducted a single-center, non-randomized, controlled study in Japan. Care workers in an intervention group received an exercise manual and a 30-minute seminar on LBP and were encouraged with a group approach, while care workers in a control group were given only the manual. All care workers answered questionnaires at the baseline and end of a 1-year study period. The subjective improvement of LBP and compliance with the exercise were evaluated.

Results: In all, 64 workers in the intervention group and 72 in the control group participated in this study. More care workers in the intervention group exercised regularly and improved or prevented LBP than in the control group ($P=0.003$ and $P<0.0001$, respectively). In the intervention group, none had a first medical consultation or were absent from disability for LBP by the end of the study period.

Conclusion: The exercise 'One Stretch' would be effective to improve or prevent LBP in care workers. Our group approach would lead to better compliance with the exercise.

Keywords: Low back pain, Standing back extension, McKenzie method, Care worker, Population strategy, Prevention

Introduction

Low back pain (LBP) is a major health problem, particularly in industrialized countries, and has affected people's life and social economy in various ways. The Global Burden of Disease Study indicated 'low back pain is one of the leading specific causes of years lived with disability (YLD)',¹ and about 85–90% of LBP has been classified as non-specific LBP.^{2–4} Low back pain-associated disability results in loss of work and huge economic impact with substantial direct and indirect social costs.^{5–7}

In Japan, as in other industrialized countries, many people suffer from LBP. Recently, a lifetime LBP prevalence of 83% and a 4-week prevalence of 36% were reported.⁸ Additionally, LBP was the fifth most

common reason for medical consultation among Japanese outpatients,⁹ and especially in the health care industry, an increasing number of care workers left the job due to work-related LBP.¹⁰

Some researchers revealed that physical activity at work, such as lifting and rather keeping forward flexion, sustained forward bending, can be associated with increased back symptoms, further aggravating pain (so-called back injuries).¹¹ In fact, frequent lifting during working hours greatly impacts non-specific LBP in Japanese workers.¹²

To deal with the socioeconomic problem of LBP, it is important to prevent LBP from developing in people without symptoms. Physical exercises have been recommended in the prevention of LBP, while there is insufficient evidence against any specific type or intensity of exercise.¹³ McKenzie, who introduced a subgroup classification method of LBP, recommends extension exercise because posterior displacement of

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the nucleus by the exercise eliminates or abolishes LBP.¹⁴ The McKenzie method is a system that classifies patients into one of the specific subgroups primarily based on symptomatic and mechanical responses to mechanical loadings. Among the LBP population, the largest subgroup where LBP is improved in a short period of time is by back extension loading strategy. Its theoretical explanation is based on the disk model in which posterior displacement of the nucleus can be reduced by deliberate extension loading strategy. This reduction of the displaced nucleus may result in decreasing or abolishing LBP.

In this study, we used a simple daily standing back extension exercise ‘One Stretch’, to evaluate the efficacy of this exercise in care workers at risk of developing and aggravating LBP.

Subjects and Methods

Study population

This study was conducted at a health care facility for the elderly, Numbu Kohoen, Japan. Eligible participants were Japanese care workers who worked there on the first and second floors and supported the elderly in need of care. We excluded the workers who had difficulties in participating due to medical causes (e.g. spinal stenosis, rheumatoid arthritis, and ankylosing spondylitis) or other personal reasons. Written informed consent was obtained from all participants.

This study was approved by the medical/ethics review board of Kanto Rosai Hospital. We registered our study (ID: UMIN000004473) in the University Hospital Medical Information Network Clinical Trials Registry (UMIN-CTR).

Study design

This was a single-center, non-randomized, controlled study. Participants who worked on the first floor were assigned to the control group, and those on the second floor to the intervention group. We provided an exercise manual for all participants and a 30-minute seminar only for the intervention group. In the exercise manual, we described how to do a standing back extension exercise ‘One stretch’ (Fig. 1). This exercise is an active extension of the back used as a common technique in physical therapy, and is based on the theory of derangement syndrome proposed by McKenzie and May.¹⁴ We also provided some evidence-based information for treatment and prevention of LBP: self-management and risk factors (e.g. psychosocial factors and fear-avoidance). A 30-minute seminar was given by an orthopedist, the author of this article, where he explained the exercise manual and this exercise.

Participants were asked whether they were willing to do this exercise. In order to promote regular exercise in the intervention group, we took a group

To Prevent Low Back Pain, Do Standing Back Extension “One Stretch”

To practice active extension of the low back, after lifting something heavy, keeping a forward flexion posture, or sitting still for an extended period.

How to do “one stretch”

Stand with your feet shoulder-width apart. Stretch backward slowly as far as possible, while exhaling for 3 seconds, without bending your knees. Repeat this exercise 1 or 2 times.

Figure 1 How to do standing back extension ‘One Stretch’.

approach and routinely monitored participants’ motivation for the exercise.

Data collection

At baseline and end of the 1-year study period, data were collected by using a self-administrated questionnaire. The baseline questionnaire contained the following items: age, sex, body mass index (BMI), visit status for medical consultation due to LBP (yes or no), the severity of LBP in the previous 1 month, and psychological factors. The severity of LBP was evaluated by the Von Kroff’s grading: (1) no pain, (2) LBP without interfering with work, (3) LBP interfering with work, and (4) LBP interfering with work, leading to sick leave.¹⁵ We defined the pain localized between the costal margin and the inferior gluteal folds⁴ as LBP, and illustrated a diagram of the LBP in the questionnaire. Psychological factors were assessed by the mental health score of SF-36 (ver.1.2).^{16,17} The questionnaire at the end of the study period assessed the subjective improvement of LBP from baseline (improved, no change, or worse), overall compliance with the exercise during the study period (good or poor), visit status for medical consultation (yes or no), and absence from work due to LBP in the previous 1 year. Participants were asked to record daily exercise to evaluate overall compliance with the exercise during the study period.

Statistical analysis

Values were presented by either means and standard deviations (SDs) or frequencies and percentages. Between-group differences of baseline characteristics were evaluated by using chi-square test for categorical variables and Student’s *t*-test for continuous variables. The subjective improvement of LBP and compliance with the exercise were evaluated by using

chi-square test. All statistical tests were two tailed and conducted with a significance level of 0.05.

On medical consultation, we evaluated the change of visit status as the following: (1) improved; participants who had consulted a doctor at baseline, but did not at the end of the study period; (2) no change (–); they had never consulted a doctor; (3) no change (+); they regularly consulted a doctor; and (4) worse; they had not consulted a doctor at baseline, but did at the end of the study period.

Results

A total of 166 care workers participated in this study and were assigned to the intervention group ($n=81$) or the control group ($n=85$). The intervention group mean age was 36.8 ± 10.9 years, men (35.8%) and women (64.2%). The control group mean age was 35.9 ± 10.9 years, men (42.3%) and women (57.7%). Thirty care workers were excluded from the analysis because they could not answer the questionnaire at the end of the study period due to moving to other facilities. The analysis population consisted of 64 care workers in the intervention group and 72 care workers in the control group. We took a group approach for the intervention group, where care workers exercise in a group at the daily meeting. This approach was continued to the end of the study period.

Baseline characteristics of the analysis population are shown in Table 1. In all items, including the severity of LBP, mental health score of SF-36, there were no statistically significant differences between the two groups.

The subjective improvement of LBP from baseline and compliance with the exercise were evaluated (Fig. 2). Compared with the control group, the intervention group indicated a higher proportion of care workers who had ‘improved’ LBP and had ‘good’ compliance with the exercise, which were statistically significant ($P=0.003$ and $P<0.0001$, respectively).

The number of care workers with/without medical consultation and absence from work due to LBP is

Figure 2 Subjective improvement of low back pain (LBP) and compliance with the exercise. Panel A is the subjective improvement of LBP from baseline to the end of the 1-year study period. Intervention group of 56 care workers and control group of 60 care workers were included due to missing data. Panel B is the overall compliance with the standing back extension exercise during the study period. Intervention group of 64 workers and control group of 68 workers were included due to missing data.

shown in Table 2. In the intervention group, there were no care workers who had a first medical consultation due to LBP, while six care workers had quit consulting a doctor by the end of the study period. Additionally, no care workers in the intervention group and five care workers in the control group had been absent from work due to LBP at the end of the study period.

Discussion

The findings of this study suggest that standing back extension exercise ‘One Stretch’ is effective to prevent care workers from developing and aggravating LBP. We considered that daily practice of this exercise would not only improve LBP but also decrease the number of care workers needing medical consultation or leaving work due to LBP. Furthermore, our group

Table 1 Baseline characteristics in intervention and control groups

Variable	Intervention ($n=64$)	Control ($n=72$)	<i>P</i> value
Age, year	38 ± 11	36 ± 11	0.39
Men	23 (35.9)	31 (43.1)	0.39
Women	41 (64.1)	41 (56.9)	
BMI	$22.3 (3.5)$	$21.9 (2.9)$	0.49
Medical consultation (+)	7 (10.9)	5 (6.9)	0.41
Severity of LBP in the previous 1 month			
No pain	21 (32.8)	25 (34.7)	0.47
LBP without interfering with work	40 (62.5)	40 (55.6)	
LBP interfering with work	3 (4.7)	7 (9.7)	
Mental health score of SF-36	61.4 ± 19.9	61.3 ± 17.9	0.97

Data were shown as mean $\pm$ SD or number of participants (%).
LBP: low back pain; BMI: body mass index.

approach would encourage better compliance with the exercise.

Several other studies have supported the use of extension exercises. Long *et al.* found that patients randomized to favorable directional preference exercises, consisting mostly of extension exercises, made significant improvements in LBP compared to those randomized to opposite or mid-range movements.¹⁸ Furthermore, a novel study of kinematic magnetic resonance imaging (kMRI) demonstrated evidence that slightly degenerated intervertebral disks moved in a posterior direction during flexion and in an anterior direction during extension.¹⁹ This may be the mechanism for clinical improvements seen in our study.

In a randomized controlled trial in which military conscripts were randomized to extension in lying exercises or a control group, the intervention group saw a significantly lower prevalence of LBP and care seeking for LBP compared to the control group.²⁰ The extension approach inhibited developing back problems in young men. This is similar to our study, even if there were differences in age, sex, and an exact posture of extensions.

In this study, there were no significant differences in the baseline characteristics, including the mental health score of SF-36 and the physical activity subscale of FABQ between the intervention and control groups. Previous studies have shown that depression is a risk factor for LBP,^{21–23} but depression, as noted by the SF-36 mental score, did not seem to affect our results.

The intervention group showed a higher improvement of LBP and had better compliance with the exercise than the control group. We also noticed that the subjective improvement of ‘no change’ included both care workers with and without LBP due to the nature of this study design. Indeed, those care workers remained healthy so that none in the intervention group had a first medical consultation or were absent from work by the end of the study period.

On the other hand, the study results suggest that a group approach may improve adherence.²⁴ Generally, a population approach is considered to

be a powerful preventive strategy that affects causal behavior in health care activity.²⁵ For instance, recommending group exercises for prevention may reduce the prevalence of LBP and save more socio-economic costs than just treating sick individuals. However, some individuals, such as those having multiple risk factors of LBP or having complaints against small preventive benefits, need an individual approach to preventive behaviors. Both population and individual approaches are required to complement each other.²⁴

There were several limitations to this study. First, the questionnaire contained retrospective questions and the participants assessed their condition of LBP 1 year after, and so the possibility for recall bias should be kept in mind. Second, we examined a small sample size and a single population. Owing to the nature of the study, cluster randomized trials with adequate sample size are needed for evaluating intervention. Thus, the generalizability of findings is limited, and the findings should be interpreted with caution. We will perform further examinations through large-scale randomized controlled trials.

Conclusion

Our results suggest that the active exercise ‘One Stretch’ is effective to control LBP in care workers. In Japan, in addition to the inadequate number of care workers and poor working environment, an increasing number of care workers with LBP disability is a serious problem. Hence, daily practice of this simple exercise would benefit our society, especially in industrial health.

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Disclaimer Statements

Contributors Ko Matsudaira and Hiroyuki Oka designed the study. Miho Hiroe, Masatomo Kikkawa, Kou Hiroe, and Ken Hiroe coordinated and supervised data collection at the site. Mari Suzuki, Takayuki Sawada, and Tatsuya Isomura carried out data analyses and drafted the manuscript.

Table 2 The number of workers with/without medical consultation and absence from work due to low back pain (LBP)

Status (baseline/end of study period)		Intervention (n=64)	Control (n=72)
Medical consultation			
Improve	±	6 (9.4)	4 (5.6)
No change (–)	–/–	57 (89.1)	65 (90.3)
No change (+)	+/+	1 (1.6)	1 (1.4)
Worse	–/+	0 (0.0)	2 (2.8)
Absence from work in the previous 1 year			
Baseline	+	0 (0.0)	3 (4.2)
End of study period	+	0 (0.0)	5 (6.9)

Data were shown as number of participants (%).

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Conflicts of interest All authors disclose no conflicts of interest.

Ethics approval This study was approved by the medical/ethics review board of Kanto Rosai Hospital.

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