Load on low back muscles during home care activities: experimental study involving novice caregivers

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Load on low back muscles during home care activities: experimental study involving novice caregivers

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Abstract

Background: Low back pain is a common symptom among caregivers working in diverse caring environments, and requires improved preventive measures.
Objective: To clarify the load on the low back muscles during home care activities.
Participants: Twenty-six healthy female university students with neither caring experience nor low back pain.
Methods: The agonist trunk and lower limb muscle activity and subjective feeling of lower back fatigue were examined in 26 female subjects during caring activities. A surface electromyograph was attached to eight selected muscles, i.e., both sides of the lumbar erector spinae, rectus abdominis, vastus laterals, and semitendinosus. To compare and contrast the caregivers' burden on their lower backs, patients' bedding environment (a traditional Japanese "futon" on the floor style verses western "bed" style) , and caregivers' caring methods ("before caring training," "after caring training," and wearing a "lumbar belt") were varied. Two-way repeated-measures analysis of variance was used.
Results: The total activity level of the right erector spinae muscle of the caregivers was significantly higher when a patient was on a bed than on a futon. The total activity of the left erector spinae muscle of the caregivers was also significantly higher with bed setting than futon setting, when the caregiver received training and when they were wearing the lumbar belt. Both sides of the rectus abdominis muscle activity were not significantly different between the bed setting and futon setting. When the caregivers cared for the patient on a futon, bilateral vastus laterals muscle activity was significantly higher before caring training than with wearing a lumbar belt. There were no significant differences in bilateral vastus laterals muscle activity when care was given on the bed. When the caregivers used self-taught technique to care for the patient, there were significantly higher levels of vastus laterals muscle activity in the futon setting than the bed setting.
Conclusions: In the bed setting, novice caregivers' left erector spinae muscle activity was significantly higher when they had training and wearing a lumbar belt. Therefore, more skill training is required to teach caregivers how to use the height of the bed more efficiently. There was no effect of wearing a lumbar belt on the fatigue level of the erector spinae muscle.

KEY WORDS

caring activities; fatigue; home care; Lumbar belt; low back load; surface electromyogram

Introduction

With an increase in the number of elderly patients requiring home care as a result of an aging society, the changes in the proportions of diseases, and a change in these changes emphasize the importance of promoting and maintaining the health of not only care receivers, but also caregivers. There are many international studies about prevalence of low back pain among nurses and caregivers

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who are working at hospitals or health care facilities [1-5]. In the author's 1-year follow-up study examining 67 family caregivers, back pain occurred within 1 year in 16.4% of caregivers and was continuously aggravated in half of them[6]. Yalcinkaya et al.[7] reported that back pain was observed in 82.8% of 64 family caregivers of stroke patients. The aggravation of back pain in caregivers is a serious problem in terms of the provision of continuous home care.

Home care beds (beds) tend to be recommended to the home care receivers to reduce the physical burden on their caregivers. However, the care is occasionally provided on a Japanese-style floor bed (futon) installed directly onto a floor covered with tatami mats in a Japanese room because this is more familiar to the majority of Japanese elderly individuals. Furthermore, futons are used to care for some patients with dementia who are at risk of falling from the bed. There is also occasion to provide care by sitting directly on the floor in Western countries; since we can eliminate the height difference between the caregiver and care receiver on the mat. Yet the caregiver in a sitting position tends to lean forward while performing care activities, which requires greater load on the caregiver's low back muscles, compared with when performing care activities on the bed. Usually the care giver of the home care is a family member who initially tends to take more time to perform care activities because of a lack of caring skills, and the low back load during such activities is likely to be greater in these individuals than in nurses and professional caregivers.

In recent years, lumbar supports (low back belts) for professional and non-professional have been commercially available to prevent severe low back pain. The majority of these belts are designed to support the lumbar curve and reduce the low back load. Since they are relatively inexpensive and easy to put on and take off, they are widely used in homes, hospitals, and other health care facilities. However, the opinions about the effectiveness of the belt in terms of preventing the low back pain of the caregiver are divided [8-12]. It has also been pointed out that there is insufficient evidence demonstrating their effects[13]. Moreover, such effects during each care activity have not been quantitatively examined.

Although it is likely that low back loads during care activities vary depending on the caring environment and skills of the caregiver, the mechanism of low back loading has not been clarified in detail. In addition, the effect of the lumbar belt on reduction of the load on low back muscles is unclear.

Until the present, it has been difficult to accurately measure the muscle activity during care activities using a surface electromyograph because of the influence of motion artifacts and noise. Consequently limiting such measurements to the load on the muscles at the moment of transferring or lifting a care receiver. With the TeleMyo 2400 (Noraxon U.S.A. Inc.), a recently developed surface electromyograph adopting artifact-free signal processing technology, the influence of artifacts and noise is reduced. Its wireless body facilitates measurements without interfering with subjects' movements. In addition, it enables eight-channel simultaneous measurements at frequencies from 10 to 950 Hz and real-time analysis of simultaneously videotaped movements. The author devised a method to continuously measure the agonist trunk and lower limb muscle activity while changing a diaper using this device[14]. With this method, it is possible to clarify the loads on the low back muscles during a series of care activities, such as diaper changing and body wiping. We found that it may be necessary for novice caregivers to acquire higher-level skills, such as creating a supporting point on the bed throughout caring activity[15]. Furthermore skilled caregiver formed a fulcrum by making contact with the mattress with their thighs and knees at the routine height (about 52 cm, about 32% of subjects' height)[16]

The evidence from this study, which examines the load on the low back muscles during care activities, may promote countermeasures against low back pain in family caregivers.

Objective

This study aimed to examine appropriate methods to perform home care activities with a reduced low back load by comparing the load on the low back muscles while changing a diaper, wiping the body, and washing the feet of a care receiver while we control the care environment (i.e., whether the patient was on the futon or bed) and caregiver's care methods (i.e., before and after caring training, and while wearing a lumbar belt).

Methods

1. Subjects

We looked for subjects to participate in the study as caregivers from our current university students in order to have access to as many subjects as possible. Caregivers for this study were recruited according to the following criteria; (1) a healthy condition, (2) female sex, (3) age of 18 to 20 years, (4) no caring experience, and (5) no low back pain. Twenty-six healthy female subjects whose mean height, body weight, and BMI were 157.8 ± 0.1 cm, 51.5 ± 7.7 kg, and 20.7 ± 2.5, respectively, participated in the study as caregivers. All subjects were right-handed.

2. Methods

The load on the low back muscles was measured during the three types of care activities before and after caring training with and without a low back belt (Back Support/ MaxBelt CH Regular; Nippon Sigmax Co., Ltd., Japan) on a futon or bed and comparatively analyzed. The three types of care activities were performed in the following order: diaper changing, genital wiping, and trouser changing; upper body wiping and jacket changing; and foot washing. The 26 caregivers performed these activities for a care receiver in the following 6 patterns at intervals of more than 15 minutes (in this order) :

1) Caring for the care receiver on the futon before caring training

2) Caring for the care receiver on the bed before caring training

3) Caring for the care receiver on the futon after caring training

4) Caring for the care receiver on the bed after caring training

5) Caring for the care receiver on the futon after caring training with the low back belt

6) Caring for the care receiver on the bed after caring training with the low back belt

Before caring training (pattern 1) or 2)) , the caregivers freely performed the care activities. Caring training was provided with an oral and written explanation of basic caring skills and a demonstration of actual care for a care receiver on the futon or bed by researchers with caring skills after measurement of pattern 1) or 2) . After the demonstration, the caregivers' levels of acquirement were confirmed by practicing once or twice; measurement of pattern 3) or 4) was then performed.

The basic caring skills to perform each activity were explained as follows. Diaper changing: placing the care receiver in a lateral position without lifting his/her body, changing a rectangular diaper, wiping his/her genital area, and changing the trousers. Wiping: placing the care receiver in a lateral position without lifting his/her body, wiping his/her back with a dry towel, and changing the jacket. Foot washing: placing a basin filled with water under the care receiver's feet then lifting, washing, and drying each foot. The caregivers were instructed to closely approach the care receiver and make full use of his/her remaining function throughout the care activities.

A 90-cm-wide and 5-cm-thick futon was installed directly onto a floor covered with tatami mats; therefore, the height of the care receiver was 5 cm. In contrast, an 80-cm-wide bed with manually removable bed rails on both sides and a carpet underneath to prevent slipping was set at 45% of the height of the caregiver.

In addition to the caregivers, care receivers were recruited according to the following criteria; a healthy condition, female sex, age of 18 to 20 years, and current university student. Ten healthy females whose mean height, body weight, and BMI were 160.6 ± 0.1 cm, 55.0 ± 8.6 kg, 21.3 ± 2.7, respectively, participated in the study as care receivers. Each caregiver cared for the same care receiver throughout the six measurements. The care receivers wore an open-front pajama jacket, trousers, and a rectangular diaper underneath. To equally simulate limited movements of a female elderly patient with severe right hemiparesis requiring care, the 10 care receivers temporarily used a right-hemiparetic elderly movement simulation device.

The measurements were performed to examine the two items described in the following subsections.

3. Agonist trunk and lower limb muscle activity during the care activities

The caregivers were equipped with the TeleMyo 2400 surface electromyograph during the six measurements. The electromyograph was set at a sampling frequency of 1500 Hz in a frequency band from 10 to 500 Hz. To evaluate agonist trunk and lower limb muscle activity, the maximum voluntary contraction (MVC) of the following eight muscles was measured and normalized (%MVC) : the left and right lumbar erector spinae (erector spinae) , rectus abdominis, vastus lateralis, and semitendinosus. The obtained %MVC values were multiplied by the time needed to perform all care activities from diaper changing

to wiping to foot washing to calculate integrals of the muscle activity during these activities. The measurement data were analyzed using MyoResearch XP Software (Noraxon U.S.A. Inc.). The measurements were simultaneously videotaped to perform real-time analysis of caring movements and muscle activity.

4. Subjective feelings of low back fatigue after performing care activities (feeling of low back fatigue)

The feeling of low back fatigue was measured after each care activity, adopting the visual analog scale (10 cm maximum). All measurements were performed at the Home Nursing Laboratory of Kanazawa University from July 2008 to September 2009.

5. Analysis

We sought to compare lumbar muscle load during care activities between each care location (i.e., futon and bed) and between experimental condition (i.e., before and after care training, and wearing a lumbar belt). The effects of care location and experimental condition on the activities of the eight muscles and subjective feeling of lumbar fatigue were assessed by two-way repeated-measures analysis of variance (two –way ANOVA). When the interaction effect was significant, we measured the simple main effect. When the number of levels were more than three, we examined with the Bonferroni test and the significance level was set at 0.05 / 3 = 0.0167. Other than that, everything was tested with 5% significant level by using IBM SPSS Statistics 23.

6. Ethical considerations

This study was conducted with the approval of the Medical Ethics Committee at Kanazawa University (February 29, 2008; approval number: 121) .All caregivers and care receivers voluntarily participated and were provided with written and oral explanations of the study objective and methods to obtain their consent. The surface electromyograph and right-hemiparetic elderly movement simulation device used in the study have been proven to be noninvasive.

Results

1.Time needed for care activities

The mean time needed to perform all care activities on the futon and bed before caring training was 13.3 ± 2.6 and 12.9 ± 2.6 minutes. After the participants received the caring training, it was 9.7 ± 1.5 minutes on the futon and 11.2 ± 1.9 minutes on the bed.

2. Effects of experimental conditions and care giver's muscle activity level during care activities

For the left erector spinae muscle activity , the interaction effect (care location × experimental condition) was significantly different ($F(2,50) = 6.03$, $p=0.004$). As a result of simple main effect of the care location , the simple main effect of the futon was significant ($F(2,150) = 4.95$, $p=0.008$), yet Bonferroni analyses revealed no significant differences. As a result of simple main effect of experimental condition, the simple main effect of care training and wearing the lumbar belt had significant effect ($F(1,150) = 8.20$, $p=0.005$; $F(1,150) = 10.21$, $p=0.002$) . For the right erector spinae muscle activity, the interaction (care location × experimental condition) was not significant. The main effect of care location were statistically significant ($F(2,50) = 14.25$, $p=0.001$), The main effect of experimental condition were statistically significant ($F(2,50) = 18.31$, $p<0.001$), yet Bonferroni analysis revealed no significant differences

For the left rectus abdominis muscle activity, the interaction (care location × experimental condition) was significant ($F(2,50) = 7.09$, $p=0.002$), yet a simple main effect of the care location and experimental condition were not significant. For the right rectus abdominis muscle activity, the interaction (care location × experimental condition) was not significant. Also, the main effect of the care location was not significant. The main effect of experimental condition were statistically significant ($F(2,50) = 8.03$, $p=0.005$), yet Bonferroni analysis revealed no significant differences.

For the left vastus lateralis muscle activity, the interaction (care location × experimental condition) was significant ($F(2,50) = 17.27$, $p<0.001$). As a result of simple main effect of the care location , the simple main effect of the futon was significantly higher than the bed setting ($F(2,150) = 8.18$, $p<0.001$). Bonferroni analysis revealed that on the futon setting, the caregivers' muscle activities were significantly higher without care training than wearing the lumbar belt. As a result of simple main effect of experimental condition, the simple main effect of self-taught way of caring had significantly higher level muscle activities ($F(1,150) = 4.65$, $p=0.032$) on the futon than on the bed. For the right vastus lateralis muscle activity, the interaction (care location × experimental condition) was significant ($F(2,50) = 25.20$, $p<0.001$). As a result

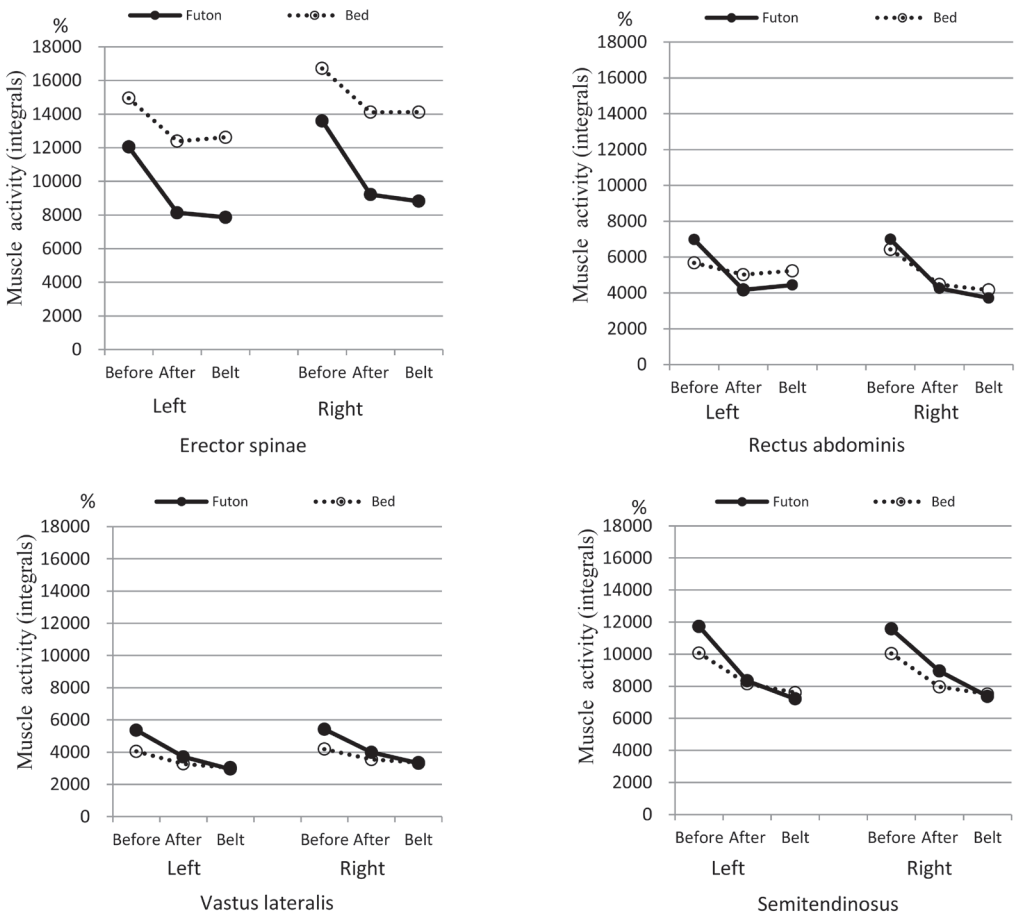

Figure1 Comparison of muscle activity (integrals) between care location (futon, bed) and experimental condition (before caring training, after caring training , or wearing lumbar belt)

Table 1. Results of two-way repeated-measures analysis of variance (n = 26)

		Futon			Bed			Main effect[1)]		Interaction[1)]
		Before caring training	After caring training	Wearing lumbar belt	Before caring training	After caring training	Wearing lumbar belt	Care location[2)]	Experimental condition[3)]	Care location[2)] × Experimental condition[3)]
Left erector spinae	Mean	12045.2	8131.7	7869.0	14651.2	12387.5	12618.9	46.97 ***	45.62 ***	6.03 **
	SD	6021.3	3857.6	4102.8	6217.2	5436.2	6005.8			
Right erector spinae	Mean	13600.4	9218.9	8818.6	16721.1	14115.7	14119.0	14.25 ***	18.31 ***	2.84 n.s
	SD	6745.2	4616.5	4469.6	10463.0	7376.5	9504.8			
Left rectus abdominis	Mean	6979.5	4167.5	4442.3	5675.2	5020.7	5230.2	0.13 n.s	6.15 **	7.09 **
	SD	6761.0	3590.8	3325.9	4722.1	4526.5	4704.6			
Right rectus abdominis	Mean	6993.5	4253.1	3717.5	6425.0	4471.2	4159.8	0.11 n.s	8.03 **	1.06 n.s
	SD	7384.2	4021.5	3131.5	7306.3	4050.4	3433.1			
Left vastus lateralis	Mean	5364.5	3710.7	2948.6	4047.1	3270.2	3035.7	4.20 n.s	19.38 ***	17.27 ***
	SD	3136.3	1842.0	1373.5	2740.8	1864.7	1718.9			
Right vastus lateralis	Mean	5425.0	3989.0	3306.7	4187.1	3306.7	3356.8	2.83 n.s	32.44 ***	25.20 ***
	SD	2520.8	1651.2	1570.5	2570.3	1570.5	2056.8			
Left semitendinosus	Mean	11728.5	8340.7	7211.0	10063.1	8154.1	7602.1	0.49 n.s	58.59 n.s	12.12 ***
	SD	5653.6	3745.9	3334.9	4275.8	3457.8	7511.5			
Right semitendinosus	Mean	11572.5	8943.3	7369.6	10038.8	7959.6	7511.5	2.72 n.s	78.15 n.s	6.02 **
	SD	4411.3	3169.6	3161.8	3606.6	2749.2	2668.5			
Subjective feelings of lumbar fatigue	Mean	6.6	5.5	4.3	6.2	5.8	4.1	0.02 n.s	13.38 ***	0.45 n.s
	SD	2.9	2.9	2.9	3.7	2.7	3.1			

1) Value of main effect and interaction is *F* value

2) Care location (Futon or Bed)

3) Experimental condition (Before caring training, After caring training , or Wearing lumbar belt)

*p < 0.05, **p <0.01, and ***p <0 .001

Table2. Result of simple main effect

Muscle Activity	Variable Factors	*F*	Bonferroni test[1)]
Left erector spinae	Effect of experimental condition with futon	4.955 **	n.s
	Effect of experimental condition with bed	1.821 n.s	-
	Effect of care location on before caring training	3.824 n.s	-
	Effect of care location on after caring training	8.202 **	Bed > Futon
	Effect of care location on wearing lumbar belt	10.217 **	Bed > Futon
Left rectus abdominis	Effect of experimental condition with futon	2.786 n.s	-
	Effect of experimental condition with bed	0.129 n.s	-
	Effect of care location on before caring training	0.986 n.s	-
	Effect of care location on after caring training	0.422 n.s	-
	Effect of care location on wearing lumbar belt	0.360 n.s	-
Left vastus lateralis	Effect of experimental condition with futon	8.189 ***	Before caring training >Wearing lumbar belt
	Effect of experimental condition with bed	1.505 n.s	
	Effect of care location on before caring training	4.659 *	Futon > Bed
	Effect of care location on after caring training	0.521 n.s	-
	Effect of care location on wearing lumbar belt	0.020 n.s	-
Right vastus lateralis	Effect of experimental condition with futon	6.775 **	Before caring training >Wearing lumbar belt
	Effect of experimental condition with bed	1.096 n.s	-
	Effect of care location on before caring training	4.440 *	Futon > Bed
	Effect of care location on after caring training	0.563 n.s	-
	Effect of care location on wearing lumbar belt	0.070 n.s	-
Left semitendinosus	Effect of experimental condition with futon	8.789 ***	Before caring training >After caring training, Wearing lumbar belt
	Effect of experimental condition with bed	2.652 n.s	-
	Effect of care location on before caring training	2.205 n.s	-
	Effect of care location on after caring training	0.028 n.s	-
	Effect of care location on wearing lumbar belt	0.122 n.s	-
Right semitendinosus	Effect of experimental condition with futon	10.469 ***	Before caring training >After caring training, Wearing lumbar belt
	Effect of experimental condition with bed	4.222 *	n.s
	Effect of care location on before caring training	2.731 n.s	-
	Effect of care location on after caring training	1.123 n.s	-
	Effect of care location on wearing lumbar belt	0.023 n.s	-

*$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$ n.s not significant
This table shows the simple main effect with interaction of significant six muscles activities
Care location (Futon, Bed)
Experimental condition(Before caring training, After caring training, Wearing lumar belt)
[1)] In the Bonferroni test, the significance level was set at 0.05/3=0.0167

of the simple main effect of the futon as a care location was significant ($F(2,150) = 6.77$, $p=0.002$). Bonferroni analyses revealed the muscle activities of care givers were significantly higher than wearing the lumbar belt. As a result of simple main effect of experimental condition, the simple main effect of before caring training was significant ($F(1,150) = 4.44$, $p=0.037$), on the futon were significant higher than on the bed.

For the left semitendinosus muscle activity, the interaction (care location × experimental condition) was significant ($F(2,50) = 12.12$, $p<0.001$). As a result of simple main effect of the care location , the simple main effect of the futon was significant ($F(2,150) = 8.789$ $p<0.001$), and Bonferroni analyses revealed before caring training were significantly higher than after caring training and wearing the lumbar belt. The main effect of experimental condition was not significant. For the right semitendinosus muscle activity, the interaction (care location × experimental condition) was significant ($F(2,50) = 6.02$, $p=0.004$) . As a result of simple main effect of the care location , the simple main effect of the futon and on the bed was significant ($F(2,150) = 10.46$, $p<0.001$、$F(2,150) = 4.22$, $p=0.016$), Bonferroni analyses revealed that on the futon setting, before caring training had significantly higher muscle activities than after caring training and wearing the lumbar belt. There was no significant difference with bed setting, also no experimental condition were significantly different.

3.The effects of care activities on the subjective feeling of lumbar fatigue

For the caregivers' subjective feeling of lumbar fatigue after performing the care activities, the interaction (care location × experimental condition) effect and the main effect of the care location were not significantly different.

However, the main effect of the experimental condition was significant ($F(2,150)=13.38$, $p<0.001$). Bonferroni analyses revealed that there was significantly higher fatigue level when the caregiver had not received any care training than when they were wearing the lumbar belt. (figure2)

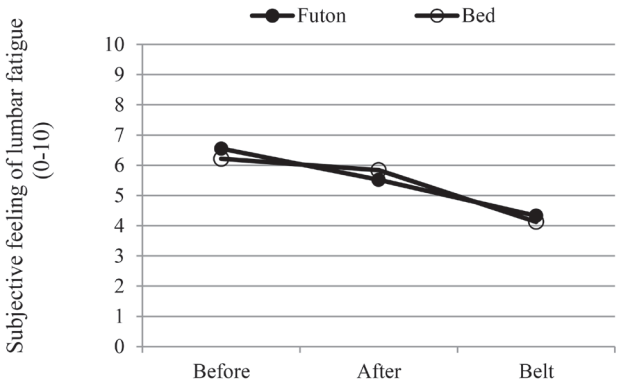

Figure 2 Comparison of subjective feeling of lumbar fatigue between care location (futon,bed) and experimental condition (before caring training, after caring training, wearing lumbar belt)

Discussion

In the majority of countries with aging populations, the development of countermeasures against low back pain is a key issue not only for nurses and professional caregivers working at health care facilities, but also for families providing home care. In this study, the effect of care activities on the low back muscles was compared between performing care activities on a futon with a height difference between the caregiver and the care receiver and bed, as well as before and after acquiring caring skills. In addition, the effectiveness of the low back belt during these activities was examined.

1. Influence of the height difference between the caregiver and care receiver on low back load

When the novice caregivers performing care activities for the patients on bed and on futon, their right erector spine muscles activities is higher with bed setting than on futon setting in any of the three experimental condition. There was no difference on the left erector spinal muscle activity before the caregivers received the training. However, after the training and when they wear the lumbar belt, there was higher level of muscle activities with bed condition than on futon condition. There was no significant effect on the rectus abdominal muscle which should protect the lower back muscles. This result indicates that novice caregivers do not use abdominal muscles effectively to prevent and protect lower back muscle pain.

Because the appropriate height of care beds in terms of low back pain prevention has not yet been determined, these heights actually tend to be adjusted based on an individual's decision in each care situation. De Looze et al[17] reported that 22 nurses set the height of the bed at 42.5% to 46.1% of their own height. In a study by Caboor et al[18] , 16 nurses set the height of the bed at 37.9% to 40.4% of their height without showing differences in low back muscle activity between the different heights. In the absence of clear evidence, care activities currently seem to be performed without appropriately adjusting the height of the bed. In this study, although the height of the bed was set at 45% of the caregiver's height, the load on the erector spinae muscles was less when care was given on the futon with a height difference. These results suggest that when we give care on a bed, it is indispensable to appropriately adjust the height of the bed in order to perform each care efficiently. Furthermore, considering that no significant differences in the feeling of low back fatigue were observed despite the fact that the load on the right erector spinae muscles varied depending on the height difference between the caregiver and care receiver, the low back load is likely to accumulate without subjective awareness through the performance of repeated care activities on the bed.

When performing care activities on a futon with a height difference with the care receiver, the caregiver tends to lean forward during care activities; based on this finding, the results of this study may represent the flexion-relaxation phenomenon [19・20] . In addition, because the study was limited to the measurement of low back muscle activity, it may be necessary to conduct further studies to clarify the relationship between low back load and trunk inclination angles.

2. Influence of caring skills on low back load

Both sides of erector spinal muscle activities did not show any significance with three experimental caregivers' conditions and two environmental conditions. Nor was there significant effect on either side of rectus abdominis. Both sides of rectus abdominis, the antagonist of the lumbar erector spinae, did not show any significant difference. In cases after caring training and wearing a lumbar belt, the left erector spine muscle activity was significantly higher with bed than with futon. It is

possible this difference was caused by the caregivers' right-handedness.

Although the initial height difference from the care receiver was marked, it was easy for the caregiver to very closely approach the care receiver and efficiently perform each care activity with the acquired skills. In contrast, in the latter cases, higher levels of caring skills may be needed in addition to basic skills to efficiently perform care activities by effectively using the height of the bed and dealing with its width.

3. Effect of the low back belt

In terms of low back pain prevention, it is recommended to use care equipment or perform the care in a team [21]. However, a large number of family caregivers engaged in 24-hour home care may find these conditions difficult because it is time and cost consuming, also physically difficult for the caregiver. Therefore relatively inexpensive low back belts which are easily removable and available at pharmacies and drug stores, are widely used. Although the majority of such belts are designed to support the lumbar curve and reduce the low back load, their effects have been negatively reported in some studies [8・9]. In fact, in the European Guidelines for Prevention of Low Back Pain [22], they are against to the use of low back belts as a preventive measure and are not recommended by them. On the other hand, Kraus et al [10] suggested their preventive effects, while Katsuhira et al [12] reported their effects on caregivers based on the findings from three-dimensional analysis. Although opinions about effectiveness of the low back belts to prevent low back pain in caregivers are vary, they are widely used in actual care environments. In this study, the feeling of low back fatigue, muscle activity of left erector spinae and lower limb muscle was reduced when performing care activities with the low back belt. However there was no reduction of the muscle activities of the Erector spinae no increase in the activity of their antagonist, the rectus abdominis. Based on these results, it may be concluded that low back belts are not effectively used by caregivers actually engaged in home care activities.

At the same time, this study was limited to analysis of agonist trunk and lower limb muscle activity in novice caregivers using a low back belt during performance of diaper changing, body wiping, and foot washing in elderly patients with right hemiparesis on a bed set at 45% of their height. Therefore, the results regarding the effect of such belts were limited and require further studies to examine their effect on skilled caregivers when caring for care receivers with different physical functions in various care environments. In addition, it is necessary to discuss and demonstrate the effective use of low back belts while performing care activities.

Limitations of this study and future challenges

In terms of ethical considerations, this experimental study solely involved healthy young females without low back pain. Considering that the majority of family caregivers are aged with a history of low back pain, it is difficult to standardize and use the results of this study in actual home care settings. With the recent increase in the number of male caregivers, it is also necessary to collect data on their muscle activity. Furthermore, the findings of this study were based on the measurement data obtained by limiting the care receivers' physical conditions and care environments.

Conclusions

The right erector spinae muscle activity during the performance of specific care activities (diaper changing, body wiping, and foot washing) was greater when performing these care activities on a bed than on a futon. The left erector spinae muscle activity after caring training and wearing the lumbar belt, were significantly higher when the care receiver was on the bed than on the futon. Both sides of rectus abdomens which is the antagonist of the lumbar erector spinae, did not show any significant differences. Lower limb muscle activity decreased with a reduced feeling of low back fatigue after caring training. The feeling of low back fatigue and lower limb muscle activity was also reduced with use of the low back belt than before caring training, while erector spinae muscle activity remained unchanged.

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在宅介護動作時の腰部筋への負荷：介護初心者における実験研究

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要　　旨

Background

介護している者の多くに腰痛が生じている。介護動作時の腰部への負荷を明らかにして、腰痛の発生を防止するための対策の強化が必要である。

Objective

本研究の目的は、在宅介護動作時における腰部筋への負荷の実態を明らかにすることである。

Methods

女子大学生 26 名を対象として、介護動作中の体幹及び下肢の主動作筋活量と主観的腰部疲労感を調査した。左右の腰部脊柱起立筋、腹直筋、外側広筋、半腱様筋の 8 筋を選出し、表面筋電計を装着して介護動作中の筋活量を計測した。介護環境（布団上とベッド上）と介護状況（自己流・介護技術習得後・腰部保護ベルト装着）による腰部負荷の違いを明らかにするため、介護動作を実施して腰部負荷を計測し、2 元配置分散分析を用いて比較分析した。

Results

右脊柱起立筋活量はベッド上での介護動作時の方が、布団上に比べて有意に高かった。左脊柱起立筋活量は、ベッド上での介護動作時の方が布団上に比べて、介護技術習得後とベルト着用は有意に高かった。腹直筋は有意な差はみとめられなかった。両側の外側広筋活量は、布団上の介護動作時は、自己流の方がベルト着用よりも高く、ベッド上では有意な差は認められなかった。自己流は、布団上の介護動作の方がベッド上よりも有意に高かった。

Conclusions

初心者は、ベッド上では介護技術習得後とベルト着用時の左脊柱起立筋活量の負荷量が高く、ベッド高の利便性をうまく活用できるように熟練した手技の習得が必要であると考える。腰部保護ベルトの装着による腰部脊柱起立筋の負荷の減少効果は認められなかった。