

Effect of the long-term care prevention project on the motor functions and daily life activities of the elderly

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Abstract. [Purpose] The purpose of this study was to verify the effects of the long-term care prevention project and develop an effective program. [Subjects] A total of 81 elderly people (age, 79 ± 5.1 years; height, 149.2 ± 9.2 cm; weight, 54.2 ± 11.4 kg). [Methods] Grip, knee extension muscular strength, 10 m walking speed, and Timed Up and Go time were measured for evaluation of motor functions, and the “Locomo 25”, a 25-question risk assessment questionnaire, was used as the judgment criterion for evaluation of daily life activities, with measurements being taken at the beginning of the project and after three months. [Results] In the motor functions evaluation, significant differences were observed in 10 m walking speed, Timed Up and Go time, and knee extension strength. In the daily life activities evaluation, scores for pain, rising movement, standing movement, indoor walking, outdoor walking, and fear of falling were significantly reduced. In addition, a significant correlation was also observed between motor functions and daily life activities. [Conclusion] The result of this study indicated that the long-term care prevention project is effective in maintaining or improving muscular strength and mitigating pain in the elderly and that it is an effective program for maintaining daily life activities. We were also able to show that it would be effective to develop programs with a low exercise intensity that can be performed on a continuing by the elderly.

Key words: Long-term care prevention project, Motor functions, Daily life activities

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INTRODUCTION

The average life span of Japanese people is one of the longest in the world, and more and more elderly people are living long lives. As aging of the population advances, needs for nursing care continue to grow with the increase in the number of elderly people requiring care and extension of the care period. Meanwhile, as the circumstances around the families who support the elderly people requiring care are also changing; for example, the number of nuclear families has increased, and the family members who provide care are aging. Therefore, the long-term care insurance system was established in 2000 as a mechanism for the all of society to support nursing care for the elderly¹⁾.

However, the number of elderly people has continued to increase since establishment of the system. To address this, community support projects, including the introduction of new “prevention benefits” and the long-term care preven-

tion project, were set up in the revision of the Long-Term Care Insurance Act of 2005. This further reinforced the viewpoint of focusing on prevention, setting the prevention of conditions requiring care and suppression of nursing care costs as big issues.

Care prevention is defined as “preventing (delay) conditions requiring nursing care to the extent possible, preventing worsening of the conditions even if the elderly person currently requires as much care as possible, and trying to mitigate such conditions”²⁾. It is also explained as “trying to improve the quality of life (QOL) by improving life functions (activity level) and participation (role level) of individual elderly people and supporting individual purposes of life and efforts towards self-actualization through improvement of mental and physical functions, environmental adjustment, and so forth instead of only trying to improve individual elements such as the motor functions and nutritional conditions of the elderly”^{2, 3)}.

More specifically, the long-term care prevention project can be classified into the three stages of primary prevention, secondary prevention, and tertiary prevention. While measures to maintain and improve life functions, mainly for elderly people who are active, are taken in primary prevention, its purpose is to maintain or improve the life functions of activeness in each of the mental, physical, and

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social phases of the elderly. Secondary prevention refers to measures to address early discovery of elderly people with a high risk of falling into conditions requiring support or care and delay such conditions through improvement of the status. In tertiary prevention, measures to improve conditions requiring care and prevent deterioration are taken for those elderly people who already require support or care²). To select candidates to participate in this long-term care prevention project efficiently, there will be surveys by each municipal government using questionnaires called the Basic Checklist. The candidates will be sorted into (1) locomotorium improvement program; (2) nutrition improvement program; (3) oral function improvement program; (4) seclusion prevention/support, cognitive function deterioration prevention/support, and depression prevention/support program; and (5) a composite program. Participation in these programs will last for periods of three to six months²).

For verification of the effects of these projects, 123 municipal governments have reported on case examples in project reports for fiscal 2011, and an evaluation of functions before and after project participation was conducted in 31 cases⁴). However, in these cases, only motor functions including walking speed and improvement in grip were evaluated, and the relationship with daily life activities was not verified in any cases. It is important that the purpose of a care prevention project is to maintain or improve daily life activities in addition to improving the motor functions of the subject elderly people, and this suggests that an exercise program that would lead to improvement of daily life activities and life quality is necessary. Furthermore, daily life movements comprise a series of physical movements that are repeated on a daily basis, and they are thus delivered as a result of integration of motor functions. It is therefore important to show the association between motor functions for movements and those for movements in daily activities.

In this study, we therefore studied the motor functions and daily life activities of the elderly people who participated in the locomotorium improvement program of the long-term care prevention project before and after program participation and tried to verify the effects of the long-term care prevention project. We also conducted examinations so that the results of this verification could be used to help develop programs for the long-term care prevention project and lead to prevention of elderly people receiving nursing care certification and suppression of financial scale.

SUBJECTS AND METHODS

A total of 89 elderly people were considered eligible for the locomotorium function improvement program based on the Basic Checklist and assessment sheet for the long-term care prevention administered by municipal governments and their participation in the programs was approved beforehand by medical doctors. Analysis was conducted for 81 of these people who participated in all measurements from the project launch until three months later (age, 79 ± 5.1 years; height, 149.2 ± 9.2 cm; weight, 54.2 ± 11.4 kg). This study was approved by the Research Ethics Committee, Faculty of Health and Sports Science, Juntendo Uni-

versity (JUSE 25-2) and was implemented after explaining its purpose of this study and obtaining agreement from the subject.

Grip, knee extension muscular strength, 10 m walking speed, and Timed Up and Go time were measured for evaluation of motor functions. For grip measurement, a digital grip dynamometer manufactured by Toei Light (Soka Japan) was used. For knee extension muscular strength measurement, isometric muscular strength with the knee joint angle fixed at 60 degrees in a sitting posture was measured with a Leg Extension/Curl unit manufactured by HUR (Kariedy, Finland) was measured using a performance recorder. Measurements were taken twice for each of the grip and knee extension muscular strength measurements, and the higher value was divided by the body weight (kgf/kg) and multiplied by 100 to expressed it as a percent (%) value. The 10 m walking speed (m/min) and Timed Up and Go time (sec) were measured at a normal walking speed, and the higher value of the two measurements was adopted. Grip, knee extension muscular strength, 10 m walking speed, and Timed Up and Go time were measured at the beginning of the projects and after three months.

For evaluation of daily life activities, "Locomo 25" a 25-question risk assessment questionnaire, adopted⁵). It is a collection of evaluation items that was prepared when "locomotive syndrome" was proposed by the Japanese Orthopaedic Association in 2009 as a term to express conditions requiring care or conditions with a high risk of requiring care due to difficulty in locomotorium movements, and evaluation is conducted on a scale of 0 to 4 points (Table 1). There are nine evaluation items: rising movement, standing movement, indoor walking, outdoor walking, fear of falling, fear of future deterioration in walking functions (future fear), and pain (upper limbs, back, and lower limbs). This evaluation was conducted at the beginning of the projects and after three months.

Under the instruction of a physical therapist, participants partook in exercise for a total of two hours comprising measurement of blood pressure and body temperature, warm-up physical exercise for 20 minutes, machine training for 60 minutes, group training for 30 minutes, and finally exercise for 10 minutes, in this order, once a week for three months. Machine training comprised two rounds of five minutes each on six types of equipment manufactured by HUR (abdomen/back, push-up/pull-down, adduction/abduction, leg press, and leg extension/curl and twist). The load for each

Table 1. Assessment score for the "Locomo 25"

Body pain				
No pain	Mild pain	Moderate pain	Considerable pain	Severe pain
0	1	2	3	4
Usual daily life				
Not difficult	Mildly difficult	Moderately difficult	Considerable difficult	Extremely difficult
0	1	2	3	4

machine was set to the minimum (1 kgf) throughout the period, and the participants were encouraged orally train in such a way that they did not experience pain and strong fatigue. The position for group training was set to a sitting position in a chair, and the participants exercised according to the oral instructions of the physical therapist using a Redcord Trainer system manufactured by Redcord.

Statistical analysis was performed for the evaluation of motor functions and daily life activities. The Student's t-test was conducted for each item at the beginning and the after three months, and Pearson's correlation coefficient was determined to examine the relevance of each. The statistical software program used was StatView 5.0, and the level significance was 5%.

RESULTS

In the evaluation of motor functions, the 10 m walking speed showed a significant increase after three months compared with the speed at the beginning of the exercise program, and the time of travel in Timed Up and Go time significant decrease. No significant change was observed in grip, while knee extension muscular strength improved significantly.

In the evaluation of daily life activities, scores for pain (upper limbs, back, and lower limbs), rising movement, standing movement, indoor walking, outdoor walking, and fear of falling decreased significantly while fear of future deterioration in walking functions did not show a significant difference (Table 2).

Regarding the relationship between evaluation of motor functions and evaluation of daily life activities, significant correlation was observed for grip with and knee extension muscular strength ($r = 0.54$, $p < 0.01$), and the rising movement ($r = -0.35$, $p < 0.05$), standing movement ($r = -0.38$, $p < 0.05$), and outdoor walking scores ($r = -0.39$, $p < 0.05$); for knee extension muscular strength with the standing movement ($r = -0.39$, $p < 0.05$) and indoor walking scores ($r =$

-0.32 , $p < 0.05$); for 10 m walking speed with the Timed Up and Go time ($r = 0.82$, $p < 0.01$) and indoor walking score ($r = 0.32$, $p < 0.05$); for the rising movement score with the standing movement ($r = 0.44$, $p < 0.05$), indoor walking scores ($r = 0.61$, $p < 0.01$), and outdoor walking scores ($r = 0.41$, $p < 0.05$); for the standing movement score with the indoor walking ($r = 0.51$, $p < 0.05$), pain in the upper limbs ($r = 0.39$, $p < 0.05$), and back pain score ($r = 0.39$, $p < 0.05$); for the indoor walking scores with the pain in the upper limbs ($r = 0.34$, $p < 0.05$), back pain ($r = 0.34$, $p < 0.05$), and pain in the lower limbs scores ($r = 0.33$, $p < 0.05$); for the outdoor walking scores with the back pain ($r = 0.34$, $p < 0.05$) and pain in the lower limbs scores ($r = 0.35$, $p < 0.05$); and for the future fear score with fear of falling ($r = 0.35$, $p < 0.05$) and back pain and pain in the lower limbs scores ($r = 0.41$, $p < 0.05$) (Table 3).

Table 2. Comparison of test results at the start of the project and those after three months

	Start	Three months
10 m walking speed (m/min)	58.6±15.3	63.2±15.1**
Timed Up and Go (min)	12.7±3.1	11.5±2.9**
Knee extension (%)	71.6±36.5	78.5±33.6**
Grip (%)	35.8±9.2	36.4±8.3
Rising movement (point)	0.6±0.7	0.3±0.4**
Standing movement (point)	0.8±0.7	0.3±0.4**
Indoor walking (point)	0.8±0.8	0.3±0.5**
Outdoor walking (point)	2.3±1.1	2.0±0.9**
Fear of falling (point)	1.0±0.9	0.6±0.7*
Future fear (point)	1.8±0.8	1.6±0.8*
Pain-upper limbs (point)	1.1±0.9	0.8±0.7*
Pain-back (point)	1.4±1.1	0.5±0.6**
Pain-lower limbs (point)	1.3±0.9	0.6±0.5**

*: $p < 0.05$, **: $p < 0.01$

Table 3. Correlation of the motor functions and daily life activities

	Grip	Knee extension	10m walking speed	Timed Up and Go	Rising movement	Standing movement	Indoor walking	Outdoor walking	Future fear	Fear of falling	Pain (upper limbs)	Pain (back)	Pain (lower limbs)
Grip													
Knee extension	0.54**												
10 m walking speed	0.15	0.15											
Timed Up and Go	0.16	0.16	0.82**										
Rising movement	-0.35*	-0.28	0.17	0.15									
Standing movement	-0.38*	-0.39*	0.22	0.21	0.44*								
Indoor walking	-0.21	-0.32*	0.32*	0.13	0.61**	0.51*							
Outdoor walking	-0.39*	-0.11	0.27	0.22	0.41*	0.03	0.02						
Future fear	-0.04	-0.26	0.18	0.22	0.05	0.14	0.11	0.18					
Fear of falling	-0.04	-0.21	0.12	0.02	0.30	0.05	0.15	0.15	0.35*				
Pain (upper limbs)	-0.03	-0.21	0.04	0.04	0.29	0.39*	0.34*	0.02	0.18	0.14			
Pain (back)	-0.05	-0.06	0.09	0.11	0.12	0.39*	0.34*	0.34*	0.18	0.31	0.17		
Pain (lower limbs)	-0.05	-0.24	0.19	0.15	0.09	0.29	0.33*	0.35*	0.19	0.09	0.05	0.41*	

*: $p < 0.05$, **: $p < 0.01$

DISCUSSION

The locomotorium improvement program in the long-term care prevention project is implemented using various methods, including methods focusing on muscular training using machines, group exercises, recreation, and games. Understanding the conditions of the target individuals and proposal of appropriate kinds of programs are and how often they should be implemented are important in conducting this project. However, we cannot deny that the exercise content currently depends on the implementation environment and therapist. In addition, various opinions have been reported regarding exercise load. A study in the 1990s reported that high-intensity training for elderly individuals admitted to nursing care facilities improved their muscular strength and walking ability and increased their amounts of voluntary physical activity⁶). It has also been reported that training to improve muscular strength conducted three times a week at 80% of maximum muscular strength for 10 weeks improved muscular strength twofold, which led the authors to recommend high-load training for the elderly⁷). On the other hand, there have also been reports indicating that the number of falls during walking did not decrease even when training to improve muscular strength was conducted⁸) and that low-load exercises are safer for those elderly people with decreased physical strength as there are risks of joint pain and an increase in blood pressure⁹). It has also been reported that low-intensity training on a continuing basis can maintain and improve the physical functions of the elderly¹⁰) and that simple training exercises conducted from a sitting position improve muscle strength in the frail elderly, and with regards to knee extension exercises, it has been reported that healthy elderly and the frail elderly individuals reached almost the same levels¹¹).

In this study, both machine training and group training were implemented, and the load in machine training was set to the minimum load (1 kg/f); and the load was set to be as low as possible using a Redcord trainer system, equipment that can reduce the needs for individual to support their own weight in group training. The exercise were conducted with as low a load as possible because many elderly people give up on programs before they are completed in the clinic when they are asked to perform exercises that cause them to feel strongly fatigued or pain. In this study, it was found that the long-term care prevention project can be effective even when the exercise load is low and that continued participation is possible, as there were significant changes in motor functions and daily life activities even when the load was low, and the reasons for giving up were found to be reasons other than the exercise load.

Furthermore, we also evaluated pain in this study. Pain is a factor that inhibits the daily life activities of the elderly and leads leading to deterioration in motor functions. In a study in 2008, it was found that 67.4% of local resident elderly people had some kind of pain, and it was reported that pain was one of the main causes of deterioration in activities of the elderly¹²). It was also pointed out in a related report on pain and ability to conduct daily life activities by the elderly that pain was related to deterioration in daily

life activities and walking ability^{13, 14}), and that mitigation of pain and prevention of worsening of pain were important factors in maintaining the motor functions and daily life activities of the elderly. While pain was significantly mitigated in the upper limbs, back, and lower limbs in the elderly people who participated in this study, we consider that exercises performed at care prevention services were also effective in reducing pain in the elderly. Based on prior studies pertaining to continuous exercise and the reduction of pain¹⁵), when dealing with elderly individuals who feel pain, it is important to provide exercise guidance that allows for continuous exercise that does not result in pain, rather than guidance that ultimately result in discontinuation of exercise due to pain.

We consider that the above results also indicate the effectiveness of the long-term care prevention project in mitigating pain in the elderly, and that it is important to instruct elderly individuals who live with pain on how to perform exercises without pain so that they do not give up on exercise. The financial cost of long-term care insurance in Japan, in which aging the population continues to advance, has increased from 3.2 trillion yen in 2000 when the Long-Term Care Prevention Act was established to 9.1 trillion yen in fiscal 2012, and it is expected to reach 18 trillion yen by fiscal 2025¹). Examining the details of the long-term care prevention project is an important issue. Since the motor functions of the elderly can be used to anticipate obstacles in their daily lives and those with lower motor functions have a higher rate of difficulties in daily life¹⁶), the long-term care prevention project plays an important role as a measure that enables them to maintain their motor functions for as long as possible. To do so, the long-term care prevention project needs to be implemented properly and actively, and program development taking into consideration the relationships between the motor functions and the daily life activities of the elderly is important. An issue that also needs to be dealt with in the future is education of the target elderly with respect to improvement methods so that they can apply short-term interventions to resolve difficulties they experience in daily life caused by deterioration in locomotorium functions and understand the necessity of programs to maintain or improve daily life activities.

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