



Original Article

Assessment of the effects of a group intervention program used in home-dwelling elderly individuals to promote home exercise and prevent locomotive syndrome

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Abstract. [Purpose] We assessed the effects of a group intervention program used in home-dwelling elderly individuals to promote home exercise and prevent locomotive syndrome. [Participants and Methods] Pre- and post-intervention evaluations were performed in all participants. Group intervention was performed thrice between the pre- and post-intervention evaluations in all participants. A total of 19 elderly individuals participated in the pre- and post-intervention evaluations. Tests used for evaluation were the two-step test, standing-up test, and 25-question geriatric locomotive function scale. [Results] Among all participants in this study, 12 who performed all 3 aforementioned tests were classified as the non-absence group, whereas 7 who were absent more than once were classified as the absence group. We examined intergroup differences with respect to changes between the pre- and post-intervention evaluations, and we observed significant changes only in the results of the two-step test. [Conclusion] We conclude that low-frequency intervention in the form of workshops led to positive results with respect to improved physical function in home-dwelling elderly individuals.

Key words: Locomotive syndrome, Locomotion training, Group intervention

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INTRODUCTION

In 2007, the Japanese Orthopaedic Association (JOA) proposed that the term “locomotive syndrome” should be adopted to designate a condition requiring nursing care, or being at risk of developing such a condition because of a decline in mobility resulting from a disorder of the locomotive system (which consists of bones, joints, muscles, and nerves)¹⁾. The JOA introduced a battery of short tests for recognizing patients with locomotive syndrome. These include the stand-up test, two-step test, and the 25-question Geriatric Locomotive Function Scale (25-question GLFS)²⁾. To prevent and treat locomotive syndrome, locomotion training is recommended in middle-aged and older participants³⁾. In a previous study, locomotion training performed independently for 3 months as monitored by using serial telephonic calls was effective in improving physical function (single-leg standing and five times sit-to-stand tests) and quality of life (SF-8)⁴⁾. Although this study showed that locomotion training had the effect of improving physical function and quality of life with minimal direct intervention by experts, there are few other reports on the effect of locomotor training. Another recent study, reported that active learning in older adults is effective in improving health literacy and physical function⁵⁾. Based on short-term intensive educational intervention, it is economically more feasible to perform independent training at home.

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In this study, educational group intervention consisted of 3 repetitions of a structured program. We decided to examine the effect of group intervention by comparing improvements in the test results among those who participated without missing any of the three interventions and those who were absent for one or more. The purpose of this study was to investigate the effects of a group intervention program aimed to promote home exercise to prevent locomotive syndrome conducted on home-dwelling elderly people.

PARTICIPANTS AND METHODS

The participants were 36 elderly home-dwelling people. Inclusion criteria were 1) people dwelling at their home, independent for activities of daily living, 2) those who could perform the three functional tests adopted in this study, 3) those with intact cognitive functions and could respond to the questionnaires conducted in this research.

All the participants underwent evaluation before and after the program. All of them participated in the group intervention programs that were held thrice between the two evaluations. The group intervention program was held once a month for 120 minutes a day. Two months after completion of the third group intervention, the end evaluation was carried out.

The group intervention program consisted of a lecture focusing on locomotive syndrome prevention (physical exercise, nutritional education, and active social participation), demonstration and practice of locomotion training (standing on one leg with eyes open, half-squats, heel raises, and front lunges), and a workshop to facilitate home exercise. Home exercises were formulated based on previous studies on prevention of locomotive syndrome^{6, 7}. Standing on one leg with eyes open is intended to enhance balance capability. One set is 1 min on each leg, and 3 sets or more a day are recommended. Half-squats, heel raises, and front lunges are representative of muscle training for the lower half of the body and balance exercise for the whole body. One set is 5 times for each exercise, and 3 sets a day or more a day are recommended. In the workshop, participants discussed how many times they could perform these exercised in a day, and how to continue home exercises.

The test battery for the evaluation comprised the two-step test, standing-up test, and the 25-question geriatric locomotive function scale (GLFS)^{2, 8}. The two-step test measures the stride length to assess walking ability, including muscle strength, balance, and flexibility of the lower limbs. The two-step test score was calculated using the following formula: length of the two steps (cm) ÷ height (cm). The standing-up test assesses leg strength by having the participant stand up on one or both legs from a specified height. After preparation of four seats of different heights—40, 30, 20, and 10 cm—the participant stood up from each seat (in descending height order), first with both legs then with one leg. In this study, if participants could stand up from a 40 cm high seat with both legs, it was regarded as 1 point, and if participants could stand up from a 10 cm high seat with one leg, it was regarded as 8 point. The 25-question GLFS is a self-administered, comprehensive measure, consisting of 25 items that include four questions regarding pain during the last month, 16 questions regarding activities of daily living during the last month, three questions regarding social functions, and two questions regarding mental health status during the last month. These 25 items are graded with a five-point scale, from no impairment (0 points) to severe impairment (4 points), and then arithmetically added to produce a total score (minimum=0, maximum=100). Thus, a higher score is associated with worse locomotive function. The reliability and validity of the scale has been thoroughly assessed⁹.

The participants who participated in both the initial and the end evaluation were analyzed. The participants who attended all three interventions were classified into the non-absence group (NAG), while those that were absent more than once were classified into the absence group (AG). At the initial evaluation, to analyze whether there is a difference between the two groups, unpaired t-test, Fisher's exact test, and Wilcoxon rank sum test were used. To analyze whether there is a difference in the initial and the end evaluation within the two groups, the paired t-test and Wilcoxon signed rank test were used. The differences in the changes from the initial to the end evaluation between the two groups were analyzed using two-way ANOVA and Scheirer-Ray-Hare test. The statistical level was set at 5%. All statistical analyses were performed using R for OS X (version 3.5.1) statistical software.

Regarding ethical considerations, this intervention program was formulated with the approval of the Hiroshima City Welfare Bureau, the administrative agency. Informed consent was obtained from all participants after they were explained the research.

RESULTS

A total of 36 people applied for initial evaluation, and 19 participants participated in both the initial and the end evaluation (5 males, 14 females, mean age 74.5 ± 7.1 years, NAG 12, AG 7) (Fig. 1).

In the initial evaluation, age, gender, exercise habits, exercise frequency, and the results of the three tests were not different between both groups (Table 1).

In the NAG, there were significant changes between the initial and the end evaluation in all tests; no significant changes were seen in the AG. In the differences between the changes in the initial and the end evaluation between the two groups, a definite difference was seen in the results of the two-step test (Table 2).

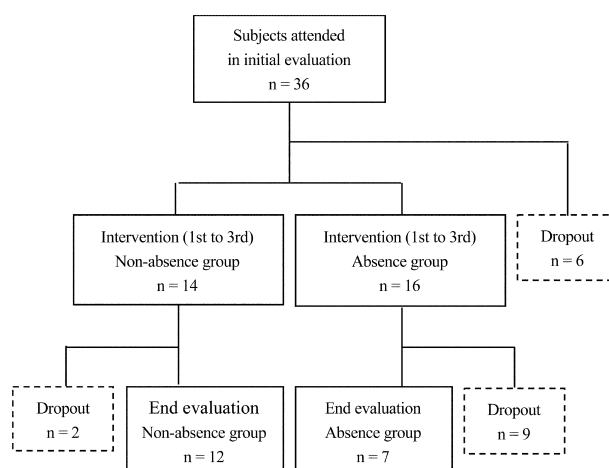


Fig. 1. Participants' attendance status in this research.

Table 1. Comparison of Non-absence group and Absence group at the initial evaluation

| | Non-absence group (n=12) | Absence group (n=7) | ES | |
|---|-----------------------------|---------------------------|-------|----|
| Age [years] ^{a)} | 74.3 ± 4.9 | 73.1 ± 9.0 | 0.162 | NS |
| Gender (Male) [n] ^{b)} | 2 | 3 | 0.287 | NS |
| Fall experience [n] ^{b)} | 3 | 1 | 0.127 | NS |
| Exercise habits [n] ^{b)} | 9 | 6 | 0.127 | NS |
| Exercise frequency (only with exercise habits) every day, 1–2/W, 1–2/M [n] ^{c)} | 6, 3, 0 | 1, 2, 1 (Unanswered=2) | 0.500 | NS |
| 25-question GLFS ^{c)} | 10.5 (3.0, 14.0) | 4.0 (1.5, 2.5) | 0.417 | NS |
| Stand-up test ^{c)} | 4 (3, 4) | 4 (3.5, 5) | 0.476 | NS |
| Two-step test [%height] ^{a)} | 1.465 ± 0.120 | 1.553 ± 0.090 | 0.759 | NS |

Mean ± SD, median (I_Q, 3_Q).

25-question GLFS: 25-question geriatric locomotive function scale; NS: Not significant; ES: Effect size.

a) Unpaired t-test (ES; Hedges' g).

b) Fisher's exact test (ES; ϕ).

c) Wilcoxon rank sum test (ES; Cliff's Δ).

DISCUSSION

In this study, we investigated the effects of a group intervention program aimed to promote home exercise for preventing locomotive syndrome, which was conducted in home-dwelling elderly people.

While 36 participants attended the initial evaluation, 19 attended the end evaluation. At initial evaluation, although there were no significant differences between the two groups, a medium effect size was indicated regarding exercise frequency, the 25-question GLFS, the stand-up test, and the two-step test. That is, the AG tended to have a higher frequency of exercise and indicated better scores in all three items of the test battery. Possibly, AG people were absent because they acquired exercise habits and were confident in their physical functions, due to which they did not feel that a group intervention program and locomotion training at home was necessary.

When assessing the differences in the changes between the initial and the end evaluations and the post-intervention differences in the two groups, a statistically significant difference was seen only in the results of the two-step test. However, on analysis of the post-evaluation changes in each group, the NAG showed significant improvement in all three tests in NAG, which was not seen in the AG. Only 50% of the initial participants underwent the end evaluation; moreover, the 25-question GLFS and stand-up test results were in the ordinal scale, due to which it seems that significant improvements did not occur. Although no significant difference was found between the two groups in the initial evaluation, significant differences were found in the end evaluation at the end of the intervention, so that, by receiving group intervention program without absence. It is suggested that the frequency of home exercise increases.

In previous studies^{4, 10}, the effect of the same locomotion training conducted in this study was examined by using the

Table 2. Comparison of Non-absence group and Absence group regarding the changes in the three indices

| | Non-absence group (n=12) | Absence group (n=7) |
|-------------------------|--|--|
| 25-question GLFS | | |
| Initial evaluation | 10.5 (3.0, 14.0) | 4.0 (1.5, 2.5) |
| Evaluation at end | 4.5 (2.75, 11.0) | 1.0 (0.0, 5.5) |
| | p=0.039, Cliffs' $\Delta=0.500^a)$ | p=0.688, Cliffs' $\Delta=0.143^a)$ |
| | | P |
| | Groups | 0.035 |
| | Evaluations | 0.362 |
| | Interaction | 0.931 ^{b)} |
| Stand-up test | | |
| Initial evaluation | 4 (3, 4) | 4 (3.5, 5) |
| Evaluation at end | 5 (4.5, 5.0) | 5 (3.5, 5) |
| | p=0.027, Cliffs' $\Delta=0.583^a)$ | p=0.500, Cliffs' $\Delta=0.286^a)$ |
| | | P |
| | Groups | 0.713 |
| | Evaluations | 0.031 |
| | Interaction | 0.321 ^{b)} |
| Two-step test | | |
| Initial evaluation | 1.465 (0.035) | 1.553 (0.034) |
| Evaluation at end | 1.559 (0.029) | 1.567 (0.022) |
| | p=0.002, Cohen's d=0.846 ^{c)} | p=0.638, Cohen's d=0.190 ^{c)} |
| | | P |
| | Groups | 0.288 |
| | Evaluations | 0.011 |
| | Interaction | 0.049 ^{d)} |

Median (1Q, 3Q), mean (SE).

25-question GLFS: 25-question geriatric locomotive function scale; NS: Not significant; SS: Sum of square.

a) Wilcoxon signed rank test.

b) Scheirer-Ray-Hare test.

c) Paired t-test.

d) Two-way ANOVA (one of the factors is repeated-measures and the other is not).

timed one-leg standing test with eyes open and five-times sit-to-stand tests. These studies were effective by using serial telephone interviews performed 3 times per week; the discussion lasted about 5 min per call and encouraged participants to continue the exercises. In this study, effectiveness was indicated with only three group interventions, held about once a month. A recent systematic review^{11, 12)} concluded that home-based fall prevention intervention was effective at reducing fall and mortality; however, there was no certain opinion about home-based frailty prevention interventions^{13, 14)}. In our study, the participants who attended all three group interventions tended to be frail. Therefore, the effectiveness of group intervention in facilitating home-based frailty prevention needs to be investigated in the future.

The limitation of this study is that we did not analyze the characteristics of 11 people (2 of NAG, 9 of AG) who dropped out after undergoing initial evaluation. Perceptions of the importance of group intervention program may be affecting as a factor of drop out. In the future study, we will clarify the factors of continuing to attend group intervention program. We did not investigate whether there was a difference of the frequency of locomotion training at home, so that, this point is also the future's work. Although the number of participants in this study was small, the effect size in the comparison of the two-step test was high at 0.846, and it seems that a certain effect was shown.

To summarize, it is medically and economically feasible to conduct group workshops to improve physical function.

Funding and Conflicts of interest

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