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Original Article

The effect of a VR exercise program on falls and depression in the elderly with mild depression in the local community

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Abstract. [Purpose] The purpose of this study is to explore the effect of a VR exercise program on falls and depression in the elderly with mild depression who reside in the local community. [Subjects and Methods] This study was performed by targeting 15 elderly subjects with mild depression who resided in the local community. The targeted subjects voluntarily selected 3 VR exercise programs (each lasting 10 minutes) among 4 activities, and a resting time of 5 minutes was given for an interval after each activity. The VR exercise program was performed for total 12 weeks (36 times), 3 times a week, 45 minutes per session. [Results] After exercise, scores of static balance test (anteroposterior), Falls Efficacy Scale, and the Activities-specific Balance Confidence Scale in the test subjects were improved and depression and internal stress scores were significantly decreased after the intervention. [Conclusion] It can be concluded that the VR exercise program exerts a positive effect not only on the physical factor but also on the mental factor of the elderly subjects with mild depression who reside in the local community. It is expected that based on the VR exercise program, diversified home programs for the elderly should be developed in the future.

Key words: The Activities-specific Balance Confidence Scale, Balance of seniors, Geriatric Depression Scale

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INTRODUCTION

Falls as a result of decrease in physical function of the elderly is one of the health problems that need to be solved on priority basis[1)]. Falls limit the normal activity of the elderly by causing serious damage such as fracture, cerebral damage and by increasing the medical cost burden and health problem[2)]. In addition, it leads to social isolation and depression in the elderly by generating a fear of falls and anxiety syndrome after falls.

In particular, as depression in the elderly may reduce quality of life and lead to suicide, it has rapidly emerged as a social problem. Falls, lowered sense of balance, and depression are not considered serious problems in the elderly as these problems are regarded as simple problems related to aging, and therefore, preventive and therapeutic support to the elderly who reside in the local community is not provided adequately[3, 4)]. Rather, such support is provided after the occurrence of falls or depression[5, 6)] and it is considered that diversified programs for the elderly residing in the local community should be developed in the future.

In particular, it is necessary to develop an easy and interesting exercise program that reflects features of the elderly rather than an exercise program that is difficult to perform with interest and involves higher cost[7, 8)]. Based on this background, in this study, a VR exercise program that is easy to tackle and has an advantage of being utilized as an individualized selection program under safe environment was applied to the elderly with mild depression[6)]. Through this procedure, we intended to

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explore the effect of the VR exercise program on physical balance and depression in the elderly[9].

SUBJECTS AND METHODS

This study was performed by targeting 15 elderly subjects aged over 65 years who used the elderly (senile) health center every day, and the selection criteria for the subjects were as follows: First, the aged subjects who had an independent gait over 10 m without an outside aid, second, a person whose MMSE-K score was more than 24 points, third, a person with mild depression whose Korean type elderly depression test GDS-K[10] score was in the range of 14–18 points, fourth, a person in whom a medication that can affect the balance was not administered. All protocols were approved by the University of Hanseo. Before participation, the procedures, risks, and benefits were explained to the participants, who gave informed consent. Participant rights were protected according to the guidelines of the University of Hanseo.

Among the selected subjects, the number of males was 5 and that of females was 10, their average age was 70.0 ± 5.94 years, and their height and weight were 156.7 ± 9.74 cm and 59.1 ± 9.74 kg, respectively.

In this study, as the VR exercise program, Wii-Fit program that was created by Nintendo, Japan in 2008 was used. In order to improve the balance, 'penguin see-saw', 'heading', 'tightrope walking', and 'marble play' activities in the program were selected. Test subjects voluntarily selected 3 activity types (each lasting 10 minutes) among 4 activities and a resting time of 5 minutes was given for an interval after each activity. The VR exercise program was performed for total 12 weeks (36 times), 3 times a week, 45 minutes per session.

In order to explore the balancing ability, efficacy and balance confidence for falls before and after exercise, the Good Balance System, Falls Efficacy Scale (Korean Version)[11, 12] and the Activities-specific Balance Confidence Scale (Korean Version)[13] were used. In addition, in order to observe the change in depression after exercise, an internal stress scale-K, a Korean type depression scale, was used. For statistical analysis, SPSS 12.0 was used, and for assessing the general features of the test subjects, technical statistics and paired t-test before and after exercise were used, and statistical confidence level was specified as α=0.05.

RESULTS

As a result of measuring the static balance ability using the good balance system, it was found that the anteroposterior balance ability of test subjects had improved (Table 1) and in the eyes open condition, the anteroposterior balance score was significantly reduced from 10.16 ± 5.06 points to 8.42 ± 4.27 points ($p<0.05$) and under the eyes closed condition, this score was significantly reduced ($p<0.05$). Static balance total score under the eyes closed condition also showed a significant improvement after the intervention ($p<0.05$).

Balance confidence of the participants after exercise was also improved. FES-K score was increased from 66.46 ± 7.72 points before the intervention to 68.80 ± 8.96 points after the intervention ($p<0.05$), and ABC-K score was also improved from 58.71 ± 7.28 points before the intervention to 61.25 ± 9.05 points after the intervention ($p<0.05$). There was a change in depression and internal stress scale-K scores of test subjects after exercise. GDS-K score was reduced from 16.27 ± 143 points before the intervention to 8.00 ± 2.44 after the intervention and ISS-K score was also reduced from 18.00 ± 2.72 points before the intervention to 16.33 ± 2.55 points after the intervention ($p<0.05$).

DISCUSSION

The VR exercise program has been generalized in a local community health center and it provides serviceability of easy home accessibility[11]. It provides several advantages of being able to perform a program safely by reducing the risk factor during training of the aged. Several preceding studies using VR have shown a positive effect mainly on muscular strength, balance and gait among the aged[12]. As physical ability could also affect the psychological factor, research on the effectiveness of both factors was considered necessary. Therefore, in this study, after performing the VR exercise program by targeting the aged with psychological depression, its effect on the physical factor and the psychological factor in the aged was explored[13].

As a result of this study, a statistically significant difference was observed in static balance, Falls Efficacy Scale, the Activities-specific Balance Confidence Scale, depression, and internal-stress items between before and after participating in the VR exercise program. In case of static balance ability of the participants, the anteroposterior score in both eyes open and eyes closed condition was reduced between before and after the intervention. In other words, it can be concluded that stable position recovery ability of the ankle joint was improved in the anteroposterior direction. In particular, in terms of balance ability control, stable position recovery ability of the ankle joint was more extensively achieved in the anteroposterior direction than in the mediolateral direction. It is considered that such an ability would induce an improvement of the static balance ability.

Falls Efficacy Scale and the Activities-specific Balance Confidence Scale scores also showed significant differences after the intervention, and this result was coincided with results of other researches which showed that falls efficacy was improved after performing the exercise program consisting of a complex exercise program and a VR program for 18 and 4 weeks, respectively.

Table 1. Change in the static balance ability of the participants (N=15)

Evaluation	Variable	Pre-exercise	Post-exercise
		M ± SD	M ± SD
Static balance	ML(EO)	4.46 ± 2.15	5.37 ± 3.65
	ML(EC)	4.80 ± 2.37	5.34 ± 3.42
	AP(EO)	10.16 ± 5.06	8.42 ± 4.27**
	AP(EC)	13.44 ± 8.50	9.52 ± 5.01**
	SW(EO)	17.02 ± 14.10	16.77 ± 15.23
	SW(EC)	22.02 ± 24.25	20.03 ± 20.71
	Total(EO)	48.00 ± 22.63	52.40 ± 23.62
	Total(EC)	65.26 ± 25.51	70.20 ± 24.63*

ML(EO): mediolateral (eyes open); ML(EC): mediolateral (eyes closed); AP(EO): anteroposterior (eyes open); AP(EC): anteroposterior (eyes closed); SW(EO): body sway (eyes open); SW(EC): body sway (eyes closed); Total(EO): total score (eyes open); Total(EC): total score (eyes closed); *p<0.05, **p<0.01.

In addition, depression and internal stress scores were reduced after the intervention. Based on this result, it is considered that the VR exercise program exerts a positive effect on psychological function of the aged and it could be extensively utilized as a therapeutic intervention for reducing depression and internal stress among the aged[14]. The VR exercise program could be easily performed at home without any spatial restriction and difficulty by learning simple mechanical manipulation[15, 16]. As it may arouse challenge and interest among the aged, the aged could experience a positive physical and psychological effect. In the future society, as the use of VR-based devices would become generalized and provide easy access, diversified intervention programs based on such devices should be developed for the disabled and the aged.

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