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Impacts of a One-Month Somatosensory Game Intervention on Reaction and Health-Related Quality of Life on Elderly

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Abstract: Because of advancement of health technology, life expectance has extended and has made global population aging dramatically. Interventions to improve health-related quality of life and social opportunity of older adults are strongly needed. In this paper, we proposed to a somatosensory video game and sedentary activity group to improve older adults' reaction and health-related quality in nursing homes. Forty older adults aged more then 65 were recruited from a nursing home and divided into two groups, a somatosensory video game and a sedentary activity group. Participants completed 30-minute somatosensory video game or 30-minute sedentary activity interventions three times a week for 4 weeks. Grasping ruler test and SF-8 were two assessment tools used to measure their progress in reaction time and health-related quality of life and to assess the benefits and outcomes of the interventions. The findings identified that the somatosensory video game intervention successfully created positive impacts on their reaction time performance and the sedentary activity intervention can improve their health-related quality of life significantly through a 30-mintue sessions three times a week for 4 weeks.

Keywords: video game, social game, play, health, quality of life, somatic learning

1. Introduction

Health technology advancement has extended global life expectance and has made population aging dramatically. In Taiwan, aging population over 65 years old exceeded more than 10% of the total population and have more than two millions people in 2012 (Ministry of Interior accounting office, 2013). Along with the fast growth of aging population, older adults who have to transfer to residential institutions or nursing homes also increase to 250,000 due to the change of family structure and the lack of family-based care givers (Coehlo, Hooker and Bowman, 2007; Gallagher et al., 2011). However, older adults who transfer to residential institutions or nursing homes may feel depressed and have poor quality of life with losing original family/social support, independence, and personal privacy (Funk, 2010). Winningham and Pike (2007) also identified that institutionalized older adults may suffer depression and have lower functions of immune system and shorter life expectancy because transitions and replacement process creates massive outflow and constrains of social opportunity. Therefore, interventions to improve health-related quality of life and social opportunity of older adults have strongly needed to be developed. According to Chiang (2012), with a variety of technology-based leisure interventions, Wii Fit programs were recommended to be used as an interventional tool was because their games were accessible and popular and the designs of their programs had numerous benefits to promote physical, psychological and social health. They believed that using somatic video games would be a viable and valuable approach to develop possible health-promoting interventions for institutionalized older adults. In this study, we proposed to use a

somatosensory video game and sedentary activity group to enhance reaction time and health-related quality of elderly in nursing homes.

2. Method

2.1 Participants

Forty older adults aged more then 65 were recruited from Yung Shin elderly nursing home and divided into two groups, a somatosensory video game and sedentary activity group. Except for one participant had to withdraw because of physical illness and personal consideration, all other participants completed 30-minute somatosensory video game or 30-minute sedentary activity interventions three times a week for 4 weeks. Pre- and post- tests were administrated before and after the interventions and were utilized to assess the benefits and outcomes.

2.2 Intervention

Table 1 demonstrates the design of two programs of the interventions. Elderly in the somatosensory game group played the "Fruit Ninja" game developed by Xbox 360 Kinect (See Figure 1). Single mode was selected and began from the beginner level in every intervention. Players who had better reaction could play longer continuously (maximum 30 minutes) and had higher scores. On the other hand, participants in the sedentary activity group, as a control group, were arranged to play arts and crafts games, such as knitting, puzzle, and tangram painting, …etc. (See Figure 2)

Table 1: Somatosensory game group with sedentary activities activity cycle.

Time	Somatosensory game group	Sedentary group
Week 1	Game teaching demonstration	Marble rolling painting
Week 2	Single mode (Recorded time record score)	Yarn knitting
Week 3	Single mode (Recorded time record score)	Popsicle stick picture frame making
Week 4	Single mode (Recorded time record score)	Tangram painting

Figure 1. Elderly played somatosensory game in seating and standing position.

Figure 2. Elderly in the sedentary activity group played arts and crafts.

2.3 Measurement

Two measurement tools were used to measure their reaction time and health-related quality of life.

2.3.1. Grasping ruler tests

In this test, examiners used a 30 centimeters ruler and placed it between examinees' thumb and index finger. Examiners reckoned one to five, and then, dropped the ruler when counting to five. Examiners had to grasp the ruler by using thumb and index finger. The scale that examinee held would be recorded. Each examinee executed this test twice and the better scores were chosen.

2.3.2 SF-8

The SF-8 health-related life quality questionnaire measured health-related quality of life. There are 8 items in this questionnaire which includes general health (GH), physical function (PF), role physical (RP), body pain (BP), vitality (VT), social functioning (SF), general mental health (MH), and role emotional (RE). Those self-report questions can contribute to two domains of health-related quality of life, physical component summary (PCS) and mental component summary (MCS). The value of PCS ranges from 0 to 63.83 and the one of MCS is from 0 to 60.73.

2.4 Data analysis

SPSS 18.0 was used for statistical analysis that included descriptive statistics and non-parametric methods, such as Mann-Whitney *U* test and Wilcoxon matched-pairs signed-rank test.

3. Findings

3.1 Demographic Background

Table 2 shows the comparison of two groups' demographic background. First of all, there is no significant difference between two groups. However, according to the result of Mini-Mental Status Examination (MMSE), older adults in both groups have mild cognitive impairments (MCI). In their regular assessments of activities of daily living (ADLs) and instrumental activities of daily living (IADLs), individuals in somatosensory game group had 64.25 points in ADLs and 6.15 points in IADLs and were considered as "partial independent" and individuals in sedentary activity group got 46.58 points in ADLs and 4.47 points in IADLs and were considered as partial independent. However, there is no significant difference between two groups due to the high standard deviation.

Table 2: Participant demographic information.

Items	Group	*n*	Mean (SD)	*p* value[a]
Age	Somatosensory game group Sedentary activity group	20 19	85.6(8.50) 81.6(5.4)	.15
MMSE	Somatosensory game group Sedentary activity group	20 19	18.90(6.70) 17.50(6.16)	.50
ADLs	Somatosensory game group Sedentary activity group	20 19	64.25(28.11) 46.58(30.69)	.07
IADLs	Somatosensory game group Sedentary activity group	20 19	6.15(4.28) 4.47(3.26)	.18

Note: a: Mann-Whitney *U* test.

3.2 Impacts on Reaction

Table 3 demonstrates the reaction improvement of both groups after intervention. Elderly in the somatosensory game group, after the four weeks "Fruit Ninja" intervention, their reaction did have significant improvement ($p < .05$). However, elderly in the sedentary activity group did not demonstrate any significant differences in reaction time performance (Table 3).

Table 3: The somatosensory game and sedentary activities in the month response capability table.

	Pre-Test	Post-Test	
Group	Mean (SD)	Mean (SD)	*p* value[a]
Somatosensory game group	19.38±6.12	15.26±7.62	.003
Sedentary activity group	21.80±5.65	17.82±8.93	.53

Note: unit to centimeters, a: Wilcoxon matched-pairs signed-rank test.

3.3 Impacts on Health-related Quality of Life

Table 4 demonstrates the improvement of health-related quality of life after intervention. Elderly in the sedentary activity group had significant improvements in both PCS ($p < .05$) and MCS ($p < .05$). However, elderly in the somatosensory game group did not show any significant improvements after the intervention.

Table 4: The somatosensory game in the month and sedentary activities related quality of life table

	Physical component summary （PCS）			Mental component summary （MCS）		
Group	Pre-Test	Post-Test	*p* value[a]	Pre-Test	Post-Test	*p* value[a]
Somatosensory game group	48.29±7.62	46.59±8.22	.18	55.24±6.88	51.97±10.55	.18
Sedentary activity group	42.69±11.76	48.37±9.22	.04	55.03±6.10	50.61±9.06	.02

Note: a: Wilcoxon matched-pairs signed-rank test.

4. Discussion

In this study, we found that somatosensory video game trainings can significantly improved reaction time on elderly who are partial independent with 4-week intervention. According to Castel, Pratt, and Drummond's (2005) research, they had similar findings and found that video game players demonstrated faster response times than non-gamers. In addition, Kwok and Tsang (2012) identified that older adults who played arts and painting can have better living qualities at home and their findings echoed our results in the sedentary activity group who had significantly improvements in both physical component summary (PCS) and mental component summary (MCS) with 4-week arts and crafts interventions.

5. Conclusion

This study identified that the "Fruit Ninja" game intervention successfully created positive impacts on their physical function, reaction time, through a 30-mintue sessions three times a week for 4 weeks. With very limited physical training, elderly in sedentary activity group did not have significant progress after the intervention. However, the sedentary activity intervention can improve their health-related quality of life significantly. With doing knitting, puzzle, and tangram painting and those sedentary activities, elderly enjoyed their additional opportunities in mental satisfaction and social interactions. Those opportunities created positive impacts on their quality of life and made them feel better.

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