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Nintendo Wii Virtual Reality Application In Older People With Alzheimer's Dementia

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Author Information:

Fatma Uğur PT[a], Meral Sertel PT, Assoc. Prof [b*]

[a] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Talatpaşa Street, Altındağ, Ankara, Turkey, TR06532. fatmakabakci1994@gmail.com

[b] Kırıkkale University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Kırıkkale, Turkey, TR71450. fzt_meralaksehir@hotmail.com

ORCID Number: Meral Sertel - 0000-0002-7575-9762, Fatma Uğur - 0000-0002-0059-5636

Corresponding Author:
SERTEL, MERAL, PT, ASSOC. PROF.
Department of Physiotherapy and Rehabilitation,
Kırıkkale University Faculty of Health Sciences
Tel: 90-318 357 37 38
e-mail: fzt_meralaksehir@hotmail.com

Nintendo Wii Virtual Reality Application In Older People With Alzheimer's Dementia

Abstract

Purpose: This study was planned to investigate the effects of the Nintendo Wii virtual reality application on muscle strength and fall risk in individuals with AD.

Method: The study included a total of 32 volunteers between the ages of 65-80, with mild or moderate AD diagnosed. These individuals were divided into 2 groups as a training group and control group. The training group was trained with games from different categories such as balance and aerobic exercises with a Nintendo Wii virtual reality device 2 times a week for a period of 6 weeks, with 1 session lasting for 30 minutes. Mini-Mental State Test, Knee Extension Muscle Strength, Timed Up and Go Test, Tinetti Falls Efficacy Scale results of individuals were recorded in the evaluation.

Results: The mean age of the control group was 73.13 ± 3.54 years, and the mean age of the training group was 73.75 ± 5.16 years. In the statistical analysis between groups, the Mini-Mental State Test values were found to be statistically significant in favor of the training group ($p=0.049$). In the intra-group statistical analysis, there was a significant difference in all tests in the training group after the training, while no significant difference was found in the control group.

Conclusions: It was found out that the virtual reality application in individuals with Alzheimer's dementia increased muscle strength and decreased the fall risk. As a result, supporting the physiotherapy and rehabilitation programs with technological developments and virtual reality applications will increase the success of the treatment.

Keywords: Alzheimer's Dementia; Muscle strength; Fall; Virtual reality

Study Procedure and Protocol

The study included a total of 32 volunteers between the ages of 65-80, who stayed in Karaman Ahmet Mete Nursing Home, Elderly Care and Rehabilitation Center, with mild or moderate Alzheimer's dementia diagnosed by a neurologist. There were 90 older people in Karaman Ahmet Mete Nursing Home, Elderly Care and Rehabilitation Center. Power analysis was performed to determine the size of the sample to be included in the study. As a result of the power analysis, assuming that the effect size to be obtained between the two groups will be large (d = 0.9), when at least 32 individuals (at least 16 individuals per group) were included in the study, it was calculated that 80% power could be obtained at 95% confidence level (with 0.05 error margin). As a result of the power analysis, it was calculated that at least 16 individuals could be included in each group (at least 32 individuals in total). 20% risk rate was determined for the individuals who could leave the study, 3 individuals were added to each group, and the study was organized with 19 individuals in each group. However, these people were excluded from the study as 4 people were not meeting inclusion criteria, 2 people were declined to participate, and therefore the study was completed with 32 individuals (Figure 1). The study included volunteers between the ages of 65-80 with mild or moderate AD diagnosis, who did not have any difficulty or problems in communicating, who did not have any neurological diseases that disrupt balance and coordination such as a cerebrovascular event, Parkinson's disease, Multiple Sclerosis, and neurological disorder, who obtained a score of 18 - 24 points in the Mini-Mental State Test (MMST) were included in the study. Patients diagnosed with rapidly progressing dementia (infection, vascular, hematologic diseases), those who could not be contacted during the follow-up period or who did not participate in the training session, those who experienced cardiac and cerebrovascular events, endocrine disorders, fluid-electrolyte imbalance and infection, those with malignancy and those who received chemotherapy and radiotherapy that causes malignancy, delirium or depression and malignant sensory loss (those with the Semmes-Weinstein monofilament thickness of 4.56 and above), and those with a lower or upper extremity amputation at any level were excluded from the study.

Among the 38 individuals with AD diagnosis, 1 individual was not included in the study after the first evaluation due to the MMST score lower than 18, 3 individuals were not included in the study due to the hearing and communication problems, and 2 individuals were not included because they did not want to start the study. The first evaluation of the patients was

performed before randomization. 32 individuals suitable for the criteria were included in the study (Figure 1). Randomization was performed by the sealed-envelope method. According to this method, 4 females and 12 males were determined to be in the control group, while 5 females and 11 males were determined to be in the training group.

The evaluation was completed before the intervention. The same evaluation was conducted after 6 weeks. The physiotherapist with more than 5 years of experience conducted all the evaluations. Exercise training was given by a another 2-year experienced physiotherapist.The training group was trained with games from different categories such as balance and aerobic exercises with a Nintendo Wii virtual reality device 2 times a week for a period of 6 weeks, with 1 session lasting for 30 minutes, and each patient was trained with the same games. In the control group, no application was performed during this period, and routine medical treatments were continued. The training group was evaluated before and after the training, while the control group was re-evaluated at the end of the 6th week after the first evaluation. After the study was completed, the volunteers from the control group were also given training.

In order to determine the sociodemographic characteristics of individuals, the case report form included questions about name and surname, age, height, weight, body mass index, dominant side, smoking, alcohol use, previous occupation, marital status, educational status, income level, number of children, social security, special healthcare needs, number of falls in the last year, vision problems, personal history, family history, medicines used, surgeries undergone, and use of a walking stick.

Their cognitive status was evaluated by the MMST. According to the MMST, 24-30 points were considered as normal cognitive levels, 18-23 points were considered as mild cognitive disorders, and 0-17 points were considered as severe cognitive disorders.

Muscle strength was evaluated by the knee extension strength. The knee extension strength was measured by a hand-held muscle strength dynamometer (Baseline Evaluation System, New York). The knee extension strength measurement was preferred in this study because it is a measurement that gives information about general lower extremity muscle strength. The knee extension strength was evaluated in the sitting position with the hip and knee joint at 90° flexion. The patient was asked to arrange his/her leg, the force was applied over the ankle, and the patient was asked to resist this force and keep his/her position. This measurement was repeated 3 times bilaterally, and the arithmetic mean of the values was taken. This

measurement was performed twice as the first and last evaluation, and the results were recorded in kg-force [24].

The fall was evaluated with the Tinetti Falls Efficacy Scale (TFES), and this scale is a 10-item scale. These items include bathing, reaching out to shelves, walking inside the house, preparing food, going to bed and getting out of bed, answering the door, sitting on the chair and getting up from the chair, getting dressed and undressed, personal care, going to the toilet and leaving the toilet. The question of "How much do you feel confident while doing the above activities?" was asked to state a point between 1 and 10. 1 means very high confidence, and 10 means no confidence. A score between 0 and 100 is obtained in total. If the total score is more than 70 points, there is fear of falling.

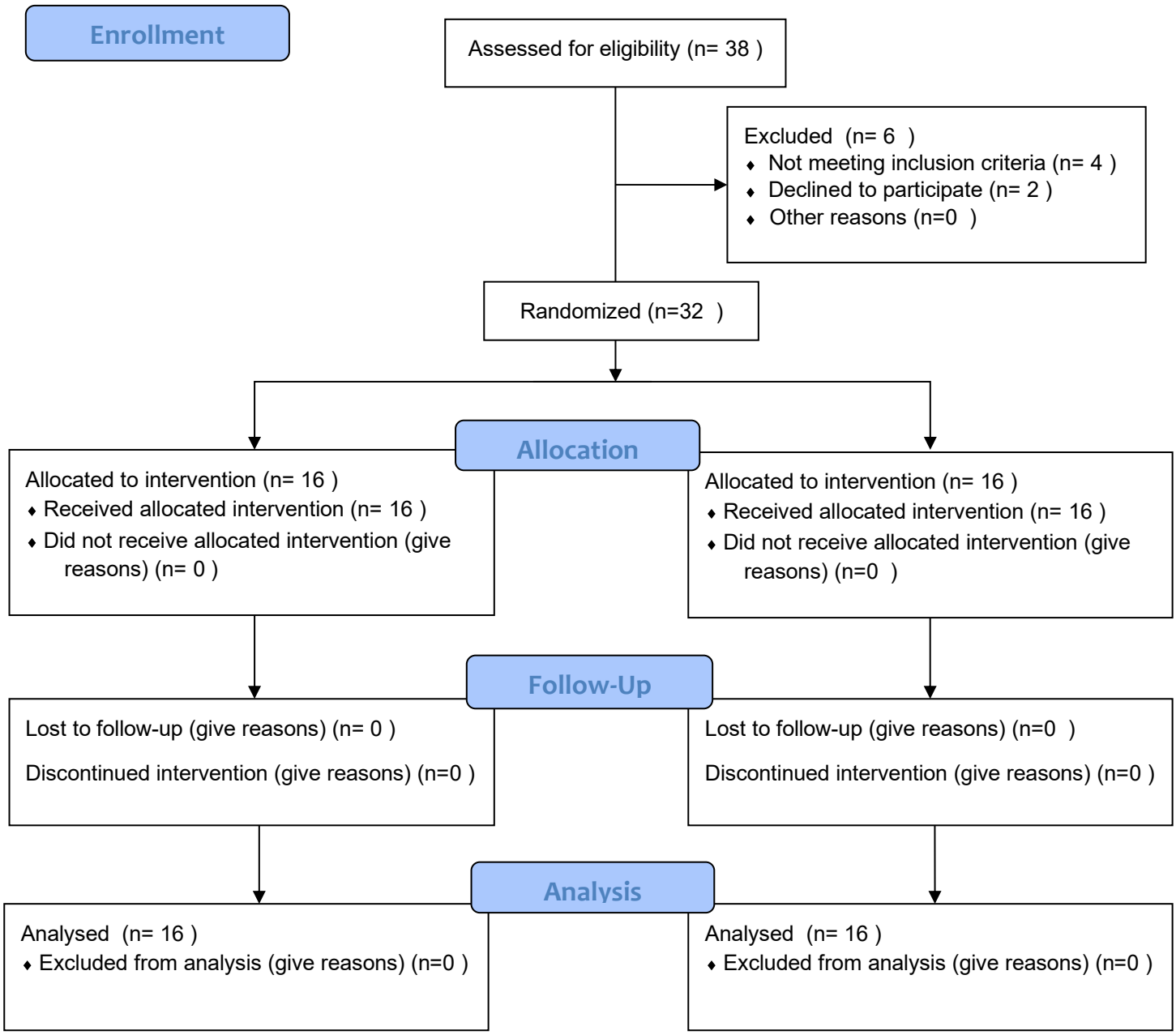
The Timed Up and Go Test (TUG) is a test that assesses the fall risk, mobility and physical performance in older people. A chair and a stopwatch are required to perform the test. The test is carried out with the patient's usual shoes, and the patient is told that he/she can use walking aids if needed. This test was performed by giving the command to the individual to get up from the chair without arm support while sitting on the chair, to walk in a predetermined 3-meter area and return, and to sit again on the chair without arm support (Image 3.1). The result was recorded in seconds (sec). If the older people completes this test in a longer time than 12 seconds, there is a fall risk.

Each part of Nintendo Wii was introduced to the individuals in the training group in the first session and games were played with the support of a physiotherapist. How to play the selected games and their objectives were explained and taught to each individual by the physiotherapist in practice. The patient was supported with verbal and physical feedback when it was noticed that the patient made wrong movements during the games played in later sessions. Games that require serious strength, balance, and coordination such as Bird's eye Bull's eye, Obstacle Course, Balance Bubble, etc. were considered as a difficult activity for the patient and were not used in this study.

The difficulty of the games was set to the simplest level for each patient. Their difficulty level was increased as the patients became successful. The difficulty of the games was increased according to the classification determined by the Nintendo Wii device. The duration of each game was different, and the games were played until the end of their times. All games were played by the patients under the same conditions, in the same environment, at the same temperature and at the same time in each session.

The permission for the study was obtained from Karamanoğlu Mehmet Bey University Faculty of Health Sciences, Non-Invasive Clinical Research Ethics Committee. Voluntary consent forms were signed by both individuals with AD and caregivers of these individuals.

CONSORT 2010 Flow Diagram



Statistical Analysis Plan

The data were analyzed using the SPSS 24.0 packaged software. Continuous variables were presented as mean ± standard deviation, median (minimum and maximum values), while categorical variables as number and percentage. The suitability of the data for normal distribution was examined by the Shapiro-Wilk test. The significance test of the difference between the two means was used in comparing the independent group differences when the parametric test assumptions were provided, and the Mann-Whitney U test was used in comparing the independent group differences when the parametric test assumptions were not provided. The significance test of the difference between the two pairs was used in comparing the dependent group differences when the parametric test assumptions were provided, and the Wilcoxon two-pPaired sample test was used when the parametric test assumptions were not provided. Differences between categorical variables were analyzed by chi-square analysis. In all analyses, $p<0.05$ was accepted as statistically significant.

Results

The mean age of the individuals was 73.13 ± 3.54 years, and the mean age of the training group was 73.75 ± 5.16 years. No statistically significant difference was found between the groups in terms of age, gender, height, weight, body mass index, occupation, marital status, education level, income level, number of children, and social security ($p>0.05$).

Upon examining the MMST values, the difference between the 2 groups was not statistically significant ($p>0.05$). In the post-training measurements, the values of the training group were significantly higher compared to the control group ($p<0.05$). When the changes in the groups before and after the training were examined, no statistically significant change was observed in the control group, whereas the values of the training group were significantly higher after the treatment ($p<0.05$) .

When the right and left knee extension muscle strength values of individuals with AD were examined, the difference between the 2 groups was not statistically significant before and after the training ($p>0.05$). When the changes of the groups before and after the training were examined, there was no significant change in the control group, whereas the values of the training group were significantly higher after the training ($p<0.05$).

When the TFES values were examined, no difference was found between the 2 groups before and after the training ($p>0.05$). When the changes of the groups before and after the training were examined, there was no significant change in the control group ($p>0.05$), whereas the values of the training group were significantly lower after the training ($p<0.05$).

When the TUG test values were examined, there was no difference between the 2 groups before and after the training ($p>0.05$). When the changes of the groups before and after the training were examined, there was no significant change in the control group ($p>0.05$), whereas the values of the training group were significantly lower after the training ($p<0.05$).

Conclusion

Along with cognitive functions, losses in motor functions such as muscle strength, balance, coordination, and walking occur in individuals with AD. A good physiotherapy and rehabilitation program is required to prevent and treat these problems. The virtual reality environment is a computer-generated three-dimensional simulation of a real-world situation in which the user can sense and control this simulation environment sensorially by means of special devices. In conclusion, the support of physiotherapy and rehabilitation programs with technological developments and virtual reality applications will increase the success of treatment especially for muscle strength, walking speed, reduction of fall risk and cognitive functions. This training may work as well, and that the results indicate that it may reduce the risk of falls.

Who to Contact

If you have any questions you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact any of the following: [Dr Meral SERTEL and PT Fatma UĞUR)

Ethic Commitee

A pilot and randomized controlled trial was conducted. Ethical approval for this study was received from Karamanoglu Mehmet Bey University, Faculty of Health Sciences, Non-Interventional Clinical Research Ethics Committee on December 27, 2017(Decision Number: 02-2017/08). In addition, this study was based on a thesis project, and permission was obtained from the Ministry of Family and Social Policies on September 26, 2017 (73595336-605.01-E.99172). Voluntary forms were signed by both AD members and those who were responsible for their care.

PART II: Certificate of Consent This section should be written in the first person and have a statement similar to the one in bold below. If the participant is illiterate but gives oral consent, a witness must sign. A researcher or the person going over the informed consent must sign each consent. The certificate of consent should avoid statements that have "I understand…."

phrases. The understanding should perhaps be better tested through targeted questions during the reading of the information sheet (some examples of questions are given above), or through the questions being asked at the end of the reading of the information sheet, if the potential participant is reading the information sheet him/herself. I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Name of Participant_____

Signature of Participant _____

Date _____ Day/month/year

If illiterate Aliterate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-print as well. Page 5 of 10 I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ AND

Participant Signature of witness _____

Date _____ Day/month/year

Statement by the researcher/person taking consent I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1.

2.

3.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent_____

Signature of Researcher /person taking the consent_____

Date _____ Day/month/year