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Original Article

# The Effects of Dual-Task Training with Online Video-Based Reminiscence Therapy on the Cognitive Status and Balance of Older People with Mild Cognitive Impairment: A Randomized Controlled Experimental Study

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## ABSTRACT

**Objectives:** This study was conducted to evaluate the effect of a dual-task training with online video-based reminiscence therapy on the cognitive status and balance of older people with mild cognitive impairment.

**Materials and Methods:** This is a randomized controlled experimental study. The study was carried out on August-October, 2018 in a Nursing Home. The study sample included 24 older people. The experimental group simultaneously did cognitive exercises including online video-based reminiscence therapy and balance exercises. The data were collected by Personal Information Form, the Standardized Mini-Mental State Examination, the Timed Up and Go Test, the Berg Balance Scale, the Single Task Timed 10 Meter Walk Test. The statistical analyses were performed using by IBM SPSS 22 and R Studio.

**Results:** The differences in the groups' scores on the Standardized Mini-Mental State Examination, the Timed Up and Go Test, the Single Task Timed 10-Meter Walk Test, and the Berg Balance Scale were found significant.

**Conclusions:** This intervention made a significant improvement in the cognitive function and the balance of older people with mild cognitive impairment.

**Keywords:** older people, dual-task training, video-based reminiscence therapy, cognitive status, balance

## INTRODUCTION

With the increase in the World's elderly population, older people's rapidly surging mild cognitive impairment rates are negatively affecting global health and healthcare systems [1,2]. Mild cognitive impairment is a significant risk factor for dementia, which is an elderly health issue and a public health priority according to the World Health Organization [1,3,4]. Cognitive and motor functions play a basic role in the functionality of older people. Cognitive disorders, balance problems and dual task dysfunction are very common in individuals with mild cognitive impairment. This affects negatively the autonomy, quality of life and wellbeing of older people [5-7].

Dual-task is described as the simultaneous usage of two or more motor activities together. Physical and cognitive exercises are performed together simultaneously in dual-task training [6]. These exercises improve the cognitive functions of older people and positively affect their physical functions [5-7]. The effects of motor-motor or cognitive-motor exercises on individuals' functionality can be examined using dual-task training. The literature includes a variety of studies on this subject [8-10]. Falbo et al. investigated the effect of cognitive-motor dual task training on the executive functions and walking performance. Their study results supported the usefulness of exercise training to enhance gait performance [11]. Fritz et al. evaluated the motor-cognitive dual-task training in neurological disorders, in their study results indicated that dual-task training may improve the cognitive status and balance levels of individuals with Alzheimer-type dementia [12]. Similarly, Mendel et al. reported that dual-task exercises are associated with cognitive status in their review [13].

In parallel with the developments in science and technology, information technologies (ITs) have recently been used for the cognitive and physical rehabilitation of the older people. The use of information and communication technologies may positively affect the effectiveness of the current practices and their results [14,15]. The literature reports that a variety of ITs are being used in dual-task training, cognitive rehabilitation and reminiscence therapy studies in the care of older people who have mild cognitive impairment [14,16-19]. The ITs-assisted interventions used in this study are safe, cost effective and practical. They are non-pharmacological interventions and recommended for use with older people who have mild cognitive impairment [16,20,21].

Reminiscence therapy is known to be the most frequently preferred non-pharmacological intervention, and evidently it maintains and improves cognitive wellbeing [22,23]. In reminiscence therapy, attention, concentration, thinking, and memory are stimulated by using therapeutic methods. This helps older people to remember, process and interpret information [24]. Recently, reminiscence therapy has begun to be assisted with information technologies, which can present multiple stimuli more realistically and simultaneously [18,25].

To the best of our knowledge, no previous studies of reminiscence therapy with cognitive-motor dual-task exercises that use online videos, depicting individuals' past experiences in a way that is unique to those years to increase the quality of cognitive stimulation in older people with mild cognitive impairment, have been conducted. Determining whether motor-cognitive dual-task training including online video-based reminiscence therapy have more effects on the cognitive status and balance levels of older people with mild cognitive impairment will contribute to the quality and functionality of their lives. This study is also important because it uses cost effective and the most updated online technologies for dual-task intervention that rapidly affects the rehabilitation of older people with mild cognitive disorder. Therefore, this study was conducted to evaluate the effect of a dual-task training including reminiscence therapy that uses online videos to depict older people past experiences on the cognitive status and balance levels of elderly nursing home residents with mild cognitive impairment.

## MATERIALS AND METHODS

### Trial Design

This is a randomized controlled experimental study. This study aimed to evaluate the effect of a dual-task training including online video-based reminiscence therapy on the cognitive status and balance levels of older people with mild cognitive impairment. The study was carried out from August 15, 2018 to October 30, 2018 in Şehit Kr. Pilot Serhat Sığnak Nursing Home, Elderly Care and Rehabilitation Center.

### Participants

The study population consist of 46 people with mild cognitive impairment who were living at the Şehit Kr. Pilot Serhat Sığnak Nursing Home, Elderly Care and Rehabilitation Center, which is affiliated with the Adana Provincial Directorate of the Ministry of Family and Social Policies. The study sample included 24 individuals (experimental group: 12, control group: 12). Eligibility criteria were following: individuals aged over 65 who spoke Turkish fluently, were diagnosed with mild cognitive impairment according to the Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) by a physician, had a Standardized Mini-Mental State Examination (SMMSE) score of 18-24 and had sufficient visual and hearing functions for group participation. Individuals who had had a surgery that could affect their balance in the last two years, who had neurological or orthopedic disorders that would prevent them from doing balance exercises or who had active psychological problems when the study was conducted did not include the study [22,26].

Before this study began, a meeting was held with the participants. Co-researcher who is a specialist psychiatric

nurse held the meeting. They were informed regarding the aim and process of the study. After given information their verbal and written consent was obtained.

Experimental group setting: A secure and comfortable environment was created for the sessions held in the rehabilitation center. During these sessions, older people watched internet videos that specifically selected themes on a widescreen that they could easily see.

Control group setting: The control group interventions were carried out in the yard of the institution.

At the end of the intervention, makeup sessions were held for the participants who missed the sessions due to hospitalization or illness during the eight-week period.

Twenty-four individuals participated in the experimental and control groups, and none of them discontinued their participation in the study.

**Interventions**

The intervention was a cognitive-motor dual task training in which it has two tasks simultaneously. The cognitive task was online video-based reminiscence therapy, and the motor task was balance exercises. The experimental group simultaneously did cognitive exercises including online video-based reminiscence therapy studies that recalling their past experiences with the researcher, who is a specialist psychiatric nurse, and balance exercises with the co-researcher, who is a specialist physiotherapist. These interventions were performed once a week for 20-25 minutes for 8 weeks.

In each session, the specialist psychiatric nurse and participants talked about the past while watching the videos and the participant was doing balance exercises with specialist physiotherapist at the same time. In each session, selected videos, depicting the participants' past, were shown and the participants were encouraged to reminisce and talk about their memories. In their cognitive exercises, the reminiscence therapy themes included an introduction, childhood and family life, school life, work and business life, entertainment, marriage, home and garden work, animals, babies and children, food and cooking, vacation and travel, celebration and evaluation [27]. All the session themes have features such as old games, toys, school life, marches, marriage ceremonies, meals, professions and songs. In each session, these subjects were discussed, and the older people shared their personal experiences. The selected videos were shown to deepen and enrich their theme/subject-related sharing. Each video was selected carefully in line with each participants' cultural and intellectual level. The videos were accessed on YouTube channel. The reminiscence therapy application guide developed by Schweitzer and Bruce [27].

In the balancing exercise, Silsupadol et al. implemented a protocol that included body stability, body stability with manipulation, then chair activities, and finally walking.

Examples of body balance tasks included standing with open and closed eyes on the firm and soft ground, shoulder-length open feet, and tandem position in 30 seconds. Examples of body balance plus manipulation tasks against the physiotherapist's efforts to destabilize those included standing open and closed eyes, on the firm and soft ground, shoulder-length open feet and tandem position in 30 seconds. Examples of chair activities included sitting and standing up, eyes open, five repetitions, sitting and standing up, and walking, eyes open, six repetitions. Examples of walking activities included tandem walking, eyes open, 10 meters.

In this study, unstructured interviews that were not related to reminiscence were conducted with the individuals in the control group during 20-25 minutes of walking done in the yard of the institution once a week for 8 weeks. These interviews included routine topics such as their illnesses and weather conditions [28].

The sessions were held in the morning, which was the optimal time since the participants were not sleeping, eating or visiting the hospital.

**Outcomes**

Cognitive status of all participants was evaluated using the Turkish SMMSE, and their balance levels were evaluated using the Timed Up and Go Test, the Berg Balance Scale and the Single Task Timed 10 Meter Walk Test before the intervention and at the end of the eight-week intervention. A personal information form was used to collect information regarding the variables at the beginning of the study. It took approximately 40 to 45 minutes to complete all the forms. The elderly people had five-minute breaks every 15 minutes while they were filling out the forms.

The data were collected by associate researchers who were psychiatric nursing and physiotherapy experts before and at the end of the eighth week the interventions.

The Personal Information Form was prepared by the researchers after reviewing the relevant literature. It has consisted of 21 questions about the socio-demographic and institutional characteristics as well as the disease and treatment-related characteristics [5,9].

The Standardized Mini-Mental State Examination (SMMSE) was developed in 1975 by Folstein et al. to evaluate cognitive functions [29]. The test consists of 11 items in five subgroups: orientation, registration, attention and calculation, and recall and language. The Turkish validity and reliability studies of the SMMSE were performed in 2002 by Gülgen et al. to account for sociocultural differences in Turkey [30]. Gülgen et al. reported that the threshold value of the scale was 23/24 with 0.91 sensitivity and 0.95 specificity, and that the inter-rater reliability was high (Pearson's coefficient: 0.99., kappa: 0.92). In 2008, Keskinoğlu et al. made versions of the SMMSE for the educated and the uneducated. They determined that a 22/23 cut-off value had the highest sensitivity (90.9%) and selectivity (97%) for the educated, while an 18/19 cut-off value had the highest sensitivity (82.7%) and selectivity (92.3%) for the uneducated [31].

The Timed Up and Go Test (TUG) is used to determine the functional mobility level and the risk of falling. Individuals are asked to stand up from a standard armchair with their feet touching the ground, walk for 3 meters, turn 180 degrees, walk back to the chair, and sit down. The test is recorded using a stopwatch. The individuals who completed this test in longer than 13.5 seconds are deemed to have a risk of falling [32,33].

The Berg Balance Scale (BBS) is used to evaluate individuals' balance. It includes 14 tasks in different postures, and the ability to fulfill these tasks and the time it takes to complete them are evaluated independently. The maximum score on the scale is 56. A scores between 0 and 20 indicate being wheelchair-bound and a 100% risk of falling, between 21 and 40 indicate being able to walk with help for the risk of falling, and between 41 and 56 indicate being able to walk independently [34,35].

The Single Task Timed 10 Meter Walk Test is used to assess the speed of walking. Individuals walk at normal speed in a designated area, and the walking duration is recorded in meters/second using a stopwatch [28].

**Sample Size**

The study population was 46 elderly people with mild cognitive impairment who were living at the nursing home. The study sample included 24 older people (experimental group: 12, control group: 12). The sample size was calculated by doing a power analysis with GPower 3.1 software. As a result of a power analysis (G*Power 3.1.9.2) performed for this experimental study based on a previously conducted study, the sample size was determined to be 12 in total for power: 0.80, β: 0.05 and α: 0.05, and to be minimum 6 for each group when the Δ: 1.92 and SD: 2.5 in the evaluation according to post-training SMMSE score [7]. Considering possible losses during the study and the statistical significance of the tests 24 older individuals (experimental group: 12, control group: 12) who resided in the care institution, met the inclusion criteria, and agreed to participate in the study were accepted the study.

**Randomization**

The co-researcher, who is a specialist psychiatric nurse, administered the SMMSE to the older people based on their educational status. Then, the names of the older people (n=46) with a SMMSE score of 18 to 24 were put in a bag and randomly pulled out of the bag to select a main group of 24 people. Then, these 24 older people were randomly allocated to the experimental and control groups by pulling their names out of a bag. The 24 nursing home residents were randomly assigned to the experimental and control groups after the similarity of age and gender variables of their sociodemographic data was confirmed. To ensure randomization, the researcher separately placed the names of men and women from the institution in bags and then randomly selected 12 individuals for the experimental and control groups. The selection process continued until similarity was achieved between the subgroups in the nursing home. Randomization was done after the baseline assessments.

The groups were similar in terms of socio-demographic characteristics (mean age, gender, education level, body mass index, number of children, and income level) ($p>0.05$). Also, there were no statistically significant differences between the groups in regards to having visitors and regular exercise ($p>0.05$).

**Statistical Methods**

The statistical analyses were performed using IBM SPSS 22 and R Studio. The descriptive statistics are presented as numbers (n) and percentages (%). The continuous variables are presented as means, standard deviations, medians, and minimum and maximum values. The categorical variables were evaluated using chi-square analysis. The assumption of normality was checked according to the groups. Parametric tests were used for variables that had a normal distribution, and for those that did not, nonparametric tests were used. The package "nparLD" (F1-LD-F1 design) was used to perform nonparametric analysis of longitudinal data in factorial experiments. The Mann-Whitney U test and Student's t-test was used for the two independent samples.

**Table 1.** The socio-demographic characteristics of the experimental and control groups

| Socio-demographic Characteristics | | Experimental Group (n=12) n (%) | Control Group (n=12) n (%) | Total (n=24) n (%) | Test Statistics; p |
|---|---|---|---|---|---|
| **Gender** | **Female** | 5 (41.7%) | 4 (33.3%) | 9 (37.5%) | p*=1.000 |
| | **Male** | 7 (58.3%) | 8 (66.7%) | 15 (62.5%) | |
| **Age (years)** | | 79.7±6.1 | 77.3±5.4 | 78.5±5.8 | t*=1.024 p=0.317 |
| **Age Group** | **<75 years** | 3 (25%) | 5 (41.7%) | 8 (33.3%) | p*=0.667 |
| | **≥75 years** | 9 (75%) | 7 (58.3%) | 16 (66.7%) | |
| **BMI (kg/m²)** | | 26.9±3.4 | 27.8±2.7 | 27.4±3.1 | t*=-0.653 p=0.521 |
| **Marital Status** | **Single** | 11 (91.7%) | 10 (83.3%) | 21 (87.5%) | p*=1.000 |
| | **Married** | 1 (8.3%) | 2 (16.7%) | 3 (12.5%) | |
| **Children** | | 3.4±1.4 | 4.4±2.8 | 3.9±2.2 | t*=-1.007 p=0.327 |
| **Education Level** | **Primary School or Less** | 3 (25%) | 7 (58.3%) | 10 (41.7%) | p*=0.214 |
| | **Primary School or More** | 9 (75%) | 5 (41.7%) | 14 (58.3%) | |
| **Income Status** | **Income<Expenditures** | 4 (33.3%) | 4 (33.3%) | 8 (33.3%) | *** |
| | **Income=Expenditures** | 7 (58.3%) | 7 (58.3%) | 14 (58.3%) | |
| | **Income>Expenditures** | 1 (8.3%) | 1 (8.3%) | 2 (8.3%) | |
| **Frequent Visitors** | **Yes** | 7 (58.3%) | 9 (75%) | 16 (66.7%) | p*=0.667 |
| | **No** | 5 (41.7%) | 3 (25%) | 8 (33.3%) | |
| **Regular Exercise** | **Yes** | 4 (33.3%) | 4 (33.3%) | 8 (33.3%) | p*=1.000 |
| | **No** | 8 (66.7%) | 8 (66.7%) | 16 (66.7%) | |
| **Medication Use** | **Yes** | 11 (91.7%) | 8 (66.7%) | 19 (79.2%) | p*=0,317 |
| | **No** | 1 (8.3%) | 4 (33.3%) | 5 (20.8%) | |

*$X^2$: Chi square test, t*: Student's t-test, p*: Fisher's exact probability test, p<0.05: threshold for statistical significance*

For dependent samples, the Wilcoxon signed-rank test and the paired t-test were used. P values of ≤0.05 were considered statistically significant.

### Ethical Considerations

Prior to the study, ethical approval was obtained from the University Ethics Committee for Clinical Research, and written permission was obtained from Governorship, Family and Social Policy Provincial Directorate.

The researcher informed the participants as regards confidentiality, privacy, and freedom of withdrawing from the study at any time. The consent of the participants was taken after verbal and written information for the study was provided to them.

## RESULTS

This study was conducted with 24 older individuals with mild cognitive impairment. Of the participants, 37.5% were female (n=9), and 62.5% were male (n=15). Their mean age was 78.46±5.79.

**Table 1** shows the inter-group distribution of the participants' sociodemographic characteristics. The participants in the groups were similar in terms of age, gender, marital status, education level, having children, BMI, and income level (p>0.05).

**Table 2** shows that comparison of the groups' post-test the SMMSE total score medians (p=0.063) found no statistically significant difference, but there was a significant difference in the within group medians (p<0.001). There was a statistically significant difference in group-time interactions (p<0.001).

**Table 3** shows that comparison of the groups' the Timed Up and Go Test post-test score medians found a statistically significant difference (p=0.006). In the within group comparisons, there was a significant difference (p<0.001) between measurement median differences. A significant difference was also found within group-time interactions (p=0.013).

**Table 2.** The evaluation of pre- and post-test median the SMMSE scores

| SMMSE | | Pre-test | | | Post-test | | | Test Value; p | Test Value; p |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean±SS | [Min-Max] | Test Value; p | Mean±SS | [Min-Max] | Test Value; p | | |
| **SMMSE** Orientation | **E** | 8.3±1.6 | 9[6-10] | U=65.0 p=0.678 | 9.3±0.8 | 9.5[8-10] | U=43.0 p=0.079 | Z=-2.326 p=0.02 | Group: WTS=1.511 p=0.219 Time: WTS=5.823 p=0.015 Group*Time: WTS=3.498 p=0.06 |
| | **C** | 8.1±1.6 | 8[6-10] | | 8.2±1.6 | 8[6-10] | | Z=-0.264 p=0.792 | |
| **SMMSE** Attention | **E** | 2.2±1.8 | 2[0-5] | t*=-0.118 p=0.907 | 4.2±0.8 | 4[3-5] | U=21.0 p=0.003 | Z=-2.615 p=0.009 | Group: WTS=4.755 p=0.029 Time: WTS=5.065 p=0.024 Group*Time: WTS=9.458 p=0.002 |
| | **C** | 2.3±1.7 | 2[0-5] | | 1.9±1.7 | 1.5[0-5] | | Z=-0.604 p=0.546 | |
| **SMMSE** Recall | **E** | 1±1.2 | 0.5[0-3] | U=68.0 p=0.806 | 1.4±1 | 1[0-3] | t*=0.398 p=0.695 | Z=-1.035 p=0.301 | Group: WTS=0.010 p=0.918 Time: WTS=2.653 p=0.103 Group*Time: WTS=0.445 p=0.505 |
| | **C** | 1.1±1.2 | 1[0-3] | | 1.3±1.1 | 1[0-3] | | Z=-0.816 p=0.414 | |
| **SMMSE** Language | **E** | 8.1±0.9 | 8[6-9] | U=67.5 p=0.78 | 8.5±1 | 9[6-9] | U=56.5 p=0.301 | Z=-1.026 p=0.305 | Group: WTS=0.524 p=0.469 Time: WTS=4.338 p=0.037 Group*Time: WTS=0.437 p=0.508 |
| | **C** | 7.9±1.1 | 8[6-9] | | 8.2±1.2 | 8.5[5-9] | | Z=-1.134 p=0.257 | |
| **SMMSE Total** | **E** | 22.6±1.6 | 23[20-24] | U=70.5 p=0.928 | 26.4±2.5 | 26.5[23-30] | U=27.0 p=0.009 | Z=-3.070 p=0.002 | Group: WTS=3.452 p=0.063 Time: WTS=37.010 p<0.001 Group*Time: WTS=19.145 p<0.001 |
| | **C** | 22.5±1.6 | 22.5[19-24] | | 22.4±2.9 | 24[18-26] | | Z=-0.045 p=0.964 | |

*WTS: Wald-type statistic, nonparametric analysis of longitudinal data in factorial experiments, U: Mann-Whitney U test, t*: Student's t-test, Z: Wilcoxon signed-rank test, p<0.05: threshold for statistical significance, E*: experimental group, C*: control group*

Comparison of the groups' post-test the Single Task 10-Meter Walking Test medians and means found statistically significant difference (p=0.019). There was a statistically significant difference between median differences in within group comparisons (p=0.004). Group-time interaction was significant (p=0.001).

Comparison of the groups' post-test the Dual Task 10 Meters Walking Test medians found no significant difference (p=0.080). The within group means and medians varied significantly (p=0.010).

Comparison of the groups' the Berg Balance Test means and medians found no statistically significant difference between their post-test medians (p=0.175), but the within group means and medians had statistically significant differences (p<0.001).

## DISCUSSION

There are studies analyzing the effects of cognitive-motor dual-task training on the cognitive status and balance levels of older people with mild cognitive impairment [9,10,17]. This present study is different in terms of used dual-task exercises with a cognitive task including online video-based reminiscence therapy.

This current study indicated that cognitive-motor dual-task training including online video-based reminiscence therapy improved the cognitive status and had a moderate effect on older people with mild cognitive impairment (p<0.001) (d: 0.518; d: 0.539) (**Table 2**). Suzuki et al. evaluated the effects of a multicomponent dual-task exercise program that stimulates the attention and memory of older people with mild cognitive impairment on biomarkers related to

**Table 3.** Evaluation of pre- and post-test the TUG, Single and Dual Task Timed 10 Meter Walk Test and BBS scores

| | | Pre-test | | | Post-test | | | Test Value; p | Test Value; p |
|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}$±SS | $\tilde{X}$ [Min-Max] | Test Value; p | $\bar{X}$±SS | $\tilde{X}$ [Min-Max] | Test Value; p | | |
| **TUG(Seconds)** | **E** | 18.2±5 | 18 [12.06-30.37] | t*=3.196 p=0.004 | 14.1±3.4 | 13.4 [10-20.01] | U=38 p=0.05 | Z=-2.589 p=0.01 | Group: WTS=7.506 p=0.006 Time: WTS=12.329 p<0.001 Group* Time: WTS=6.091 p=0.013 |
| | **C** | 12.1±4.4 | 10.2 [7.63-20.66] | | 11.5±4.2 | 9.6 [7.78-19.38] | | Z=-1.334 p=0.182 | |
| **Single Task Timed 10 Meter Walk Test (Seconds)** | **E** | 23.2±6.8 | 21.6 [14.91-40.61] | U=26.5 p=0.009 | 18.4±4.1 | 17.8 [13.13-28] | t*=1.283 p=0.213 | Z=-2.510 p=0.012 | GrOup: WTS=5.537 p=0.019 Time: WTS=8.264 p=0.004 Group* Time: WTS=10.591 p=0.001 |
| | **C** | 16.2±5.8 | 14.3 [10.5-27.5] | | 16±4.9 | 15.4 [10.41-23.81] | | Z=-.157 p=0.875 | |
| **Dual Task Timed 10 Meter Walk Test (Seconds)** | **E** | 30.5±12.6 | 26 [18-61.42] | U=37 p=0.043 | 23.4±3.6 | 23 [17-28.92] | t*=1.248 p=0.227 | Z=-2.353 p=0.019 | Group: WTS=3.057 p=0.080 Time: WTS=6.577 p=0.010 Group* Time: WTS=1.108 p=0.292 |
| | **C** | 22.5±4.4 | 21 [14.59-30.83] | | 21±5.5 | 20.5 [11.81-28.69] | | Z=-1.334 p=0.182 | |
| **BBS** | **E** | 45±4.1 | 44.5 [39-52] | t*=-2.252 p=0.035 | 49.7±3.9 | 51 [42-54] | U=67.5 p=0.794 | Z=-2.943 p=0.003 | Group: WTS=1.838 p=0.175 Time: WTS=12.634 p<0.001 Group* Time: WTS=9.721 p=0.002 |
| | **C** | 49.3±5.3 | 50.5 [40-56] | | 49.4±5 | 51.5 [40-54] | | Z=-.144 p=0.886 | |

*WTS: Wald-type statistic, nonparametric analysis of longitudinal data in factorial experiments, U: Mann-Whitney U test, t*: Student's t-test, Z: Wilcoxon signed-rank test, p<0.05: threshold for statistical significance, E*: experimental group, C*: control group*

cognitive status and cognitive functions. They found out that this program significantly improved the cognitive status of older people (p=0.004) [10]. Also, Gonzalez-Palau et al. showed a significant improvement in global cognitive function, verbal memory, attention, episodic memory, and symptoms of depression (p=0.04) [17]. In a review study, the researchers reported that cognitive stimulation through computers and virtual reality glasses has a moderate effect on older people with moderate cognitive impairment [14]. In literature, It has shown that cognitive rehabilitation performed with multimedia is more effective [14,19]. However, Stliadis et al. assessed the effects of computer-based cognitive and physical exercises on neuroplasticity, and they reported insignificant improvement in cognitive status of older people [36]. Besides, Mrakic-Sposta et al. analyzed the effects of physical and virtual education on cognitive impairment and oxidative stress of patients with mild cognitive impairment. They reported a slight improvement of the patients cognitive status that it was not statistically significant (p>0.005) [37].

In the present study, dual-task training with online video-based reminiscence therapy had a moderate effect on the cognitive status of the intervention group. Using the videos culturally and intellectually relevant selected may have provided an enhanced multi stimulus on perception, language, and attention in the dual-task training. Thus, it has improved the effectiveness of the reminiscence therapy in the dual task training [38,39]. This study results in line with the results in the literature regarding the positive effect of cognitive-motor dual-task exercise on older people with mild cognitive impairment.

In this study, the balance of the participants improved after the intervention. Bahureksa et al. reported that mild cognitive impairment negatively affects of the balance and single task walk speed at a moderate or high level [40]. Lipardo et al. conducted a study to evaluate the effects of cognitive training and physical exercise on falling and the factors related to falling in older people with mild cognitive impairment and found out that cognitive training and

physical exercise positively affect balance [41]. Similarly, Park et al. indicated that the cognitive-motor dual-task training improved cognitive function and physical function in patients with mild cognitive impairments [42]. Shimada et al. showed that dual-task training positively affected the physical function of people with mild cognitive impairment [10]. Bruderer-Hofstettera et al. conducted a meta-analysis study that assessed the effects of multicomponent dual-task exercise on cognitive function, physical capacity and daily activities in the elderly with and without cognitive impairment. They reported that multicomponent interventions are more effective compared to active comparison interventions and no treatment [9]. Delbroek et al. carried out a randomized controlled study on the effects of computer-based cognitive and motor dual-task training on elderly people's cognition, balance and dual-task performance, and indicated that total TUG duration improved on a significant level after 6 weeks of training, and it had a significant effect on the dynamic balance during single task walk [43]. Combourieu Donnezana et al. also stated that computer-based cognitive training and aerobic physical exercise positively affected the physical activity and balance of older people with mild cognitive impairment [44]. Liao et al. showed that dual-task exercises with virtual reality improved older people with mild cognitive impairment their balance and functionality more [45]. It can be said that the results of this current study are more efficient than the other study results mentioned above.

In the activities that include cognitive and physical tasks, young adults automatically give priority to motor tasks rather than cognitive tasks, while elderly adults give priority to cognitive tasks [46]. According to this study, improving the mental states of the elderly may facilitate their moves because it also affects the ability to focus. These study results about physical function are similar to and support those in the literature.

### Study Limitations

The same specialist physiotherapist/co-researcher performed the interventions/motor exercises in this study and rated the TUG, BBS, Single Task Timed 10 Meter Walk Test before and after the intervention. Although this study is randomized and controlled, it is not single blind. This is one of its limitations.

## CONCLUSION

In this study, an eight-week dual-task exercise training program including online video-based reminiscence therapy improved the cognitive function and balance of individuals with mild cognitive impairment.

According to these results, this intervention should be used in nursing homes to care older people with mild cognitive impairment.

Further studies that use dual-task training including online video-based reminiscence therapy should be conducted with larger sample groups.

The effect of cognitive exercises should be examined by various videos in reminiscence therapy.

**Author contributions:** **AIM** and **EII** designed the study. **SB** and **EII** collected data. **AIM**, **EII** and **SBY** analyzed the data. **AIM** and **EII** prepared the manuscript. All authers approved the final version for submission.

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**Data availability:** Data generated or analysed during this study are available from the authors on request.

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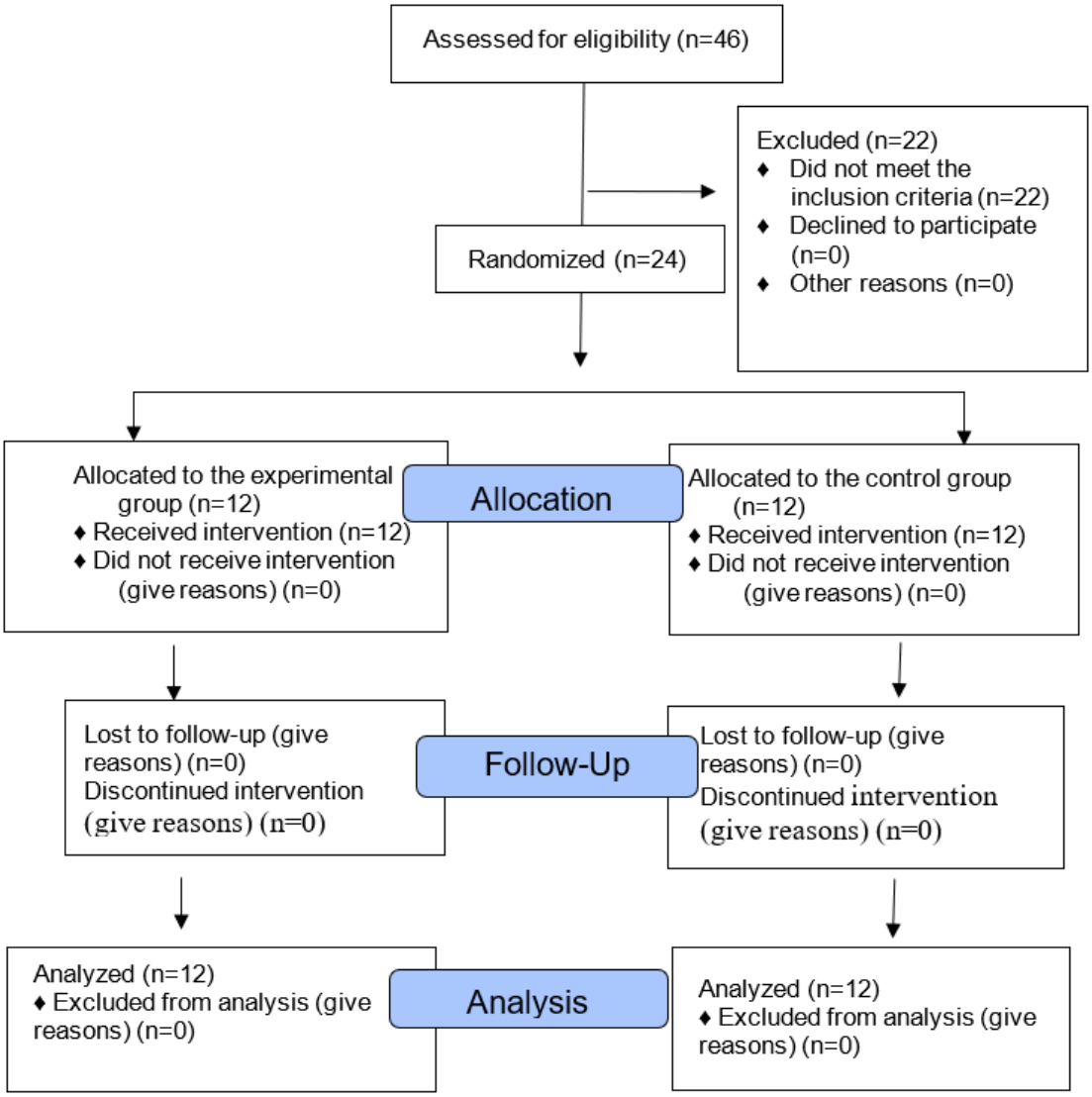
**APPENDIX**

**Study Flow Chart**

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