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Exercise training for depressed older adults with Alzheimer's disease

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Abstract

The purpose of this study was to compare the effects of 16 weeks of a comprehensive exercise routine to supervised walking and social conversation on depression in nursing home residents with Alzheimer's disease (AD). Method: This study was a three-group, repeated-measures design with random assignment to treatment group. Forty-five nursing home residents with moderate to severe AD were randomly assigned to a 16-week programme of comprehensive exercise, supervised walking or social conversation. Raters were blinded to treatment group assignment. Major outcome variables were depression measured by the Cornell Scale for Depression in Dementia, mood measured by the Dementia Mood Assessment Scale and the Alzheimer's Mood Scale, and affect measured by the Observed Affect Scale. Depression was reduced in all three groups with some evidence of superior benefit from exercise. Depression is a common problem with serious and costly consequeuces for nursing home residents with AD. Exercise as a behavioural approach to treatment of depression in nursing home residents with severe AD evidenced a clear benefit to participants in this study. More research is needed to clarify the relative benefits of different types of exercise in conjunction with or without pharmacological intervention.

Introduction

Up to 87% of older adults with Alzheimer's disease (AD) are estimated to be depressed (Carpenter, Ruckdeschel, Ruckdeschel & Van Haitsma, 2002). Depressed nursing home residents with dementia are more isolated, have higher morbidity and physical pain, exhibit greater dependency and more behavioural problems, and generate higher healthcare costs as compared to other residents (Bartels, Clark, Peacock, Dums & Pratt, 2003; Evers et al., 2002; Kales et al., 1999; Menon et al., 2001; Snowden, Sato & Roy-Byrne, 2003; Yaffe, Barnes, Nevitt, Lui & Covinsky, 2001).

Exercise has been shown to be effective in reducing depressive symptomatology in normal older adults, cognitively intact depressed older adults and older adults with medical illnesses (Blumenthal et al., 1999; Mather et al, 2002; Mazzeo et al., 1998; North, McCullagh & Tran, 1990; Singh, Clements & Fiatarone, 1997). Less is known about the effects of exercise on depression in older adults with AD. There are no studies of the relative effectiveness of a comprehensive exercise routine versus walking on depressive symptomatology for older adults with advanced AD.

Because the communication dysfunctions associated with AD interfere with the use of traditional psychotherapy (Hendryx-Bedalov, 2000), pharmacotherapy is the primary form of treatment for AD depression. Less than half of those treated are reported to improve (Boyle et

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al., 2004). Side-effects can lead to discontinuing pharmacotherapy (this includes the newer antidepressants) (Blumenthal et al., 1999; Cornelius, Katona & Hunter; 1998). Coexisting medical conditions may also limit the use of antidepressants.

Several researchers have reported promising results with exercise in depressed older adults with mild to moderate cognitive impairment. In a randomized controlled trial, Fiatarone (1994) and her research team studied strength training in 100 mildly impaired and unimpaired older adults. They compared ten weeks of lower extremity resistance exercise three days per week to an activity (e.g. walking, games, discussion groups). Geriatric Depression Scale (GDS) scores improved significantly for participants in the exercise group (n=25).

In a controlled trial with 72 depressed community-dwelling older adults with early to moderate AD, Teri, Logsdon, Uomoto & McCurry (1997) studied the effects of exposure to pleasant events including walking. The researchers demonstrated a significant decrease in depression levels for these dementia-diagnosed individuals.

In another study, Teri et al. (2003) compared 12 hours of exercise training over 12 weeks (endurance, strength training, balance and flexibility) to routine medical care in 153 community-dwelling persons with AD (mean Mini-Mental State Examination [MMSE: Folstein et al., 1975 score of 16.8; SD=7.1). They reported reduced depression in the exercise group (average 0.5 points on the Cornell Scale for Depression in Dementia) and increased depression (average 0.5 points on the Cornell Scale for Depression in Dementia) for the usual care group.

Heyn (2003) reported positive effects of a multi-sensory exercise programme on mood in institutionalized older adults with dementia. Mood improved in over 61% of the participants in this quasi-experimental study. Weaknesses of the study included non-blinded raters, subjective measures of mood, a small sample (13 participants), a complex intervention combining exercise with other interventions and no control group.

Arkin (2003) conducted a one-group study of exercise combined with conversation and cognitive stimulation with community-dwelling participants with mild to moderate dementia. After several months, participants' GDS scores improved significantly. The study was limited by the combination of exercise with other non-exercise interventions, lack of a control group and a small sample (24 participants including some individuals who were not cognitively impaired).

Two additional studies of exercise treatment for cognitively impaired older adults reported negative results. Molloy, Beerschoten, Bartie, Crilly & Cape (1988) tested an exercise intervention consisting of two 45-minute sessions spaced one week apart. This brief exercise programme (one week) would be unlikely to have any effect on depression. MacRae et al. (1996) compared a twelve-week walking programme (five days a week, 30 minutes a day) in a nursing home setting with 19 participants to a comparison group of 12 participants who received social visits. Those with an MMSE score of 15 or above were given the GDS to measure depression. Mean pre-test GDS scores were at or below the cutoff for depression (score greater than five) in both groups. They found no significant changes in depression scores from pre-test to post-test but participants had few depressive symptoms at pre-test.

Summary

There is a great need for non-pharmacological interventions for depression in moderate to late stage AD. These individuals are less able to participate in talking therapies and more at risk for adverse effects of antidepressant medications than are other depressed older adults (Blumenthal et al., 1999). Although exercise promises to have the potential to decrease

depression in this group, there is insufficient evidence demonstrating efficacy. Previous studies either had few controls or were focused on depressed older adults who were unimpaired or in early to middle stage dementia. In the current study, the researchers addressed these gaps by incorporating a control group, recruiting nursing home residents with advanced AD who met screening criteria for depression and separating exercise from non-exercise interventions.

Purpose

The purpose of this study was to examine the effects of exercise training on depressive symptomatology and mood in depressed nursing home residents with AD disease. This study was part of a larger study of the effects of exercise in Alzheimer's disease.

Methods

Design

This study was a three-group, repeated-measures quasi-experimental design with random assignment to treatment group. The three treatment groups were comprehensive exercise, supervised walking and social conversation. Raters were blinded to treatment group assignment.

Participants were randomly assigned to the three treatment groups following pre-testing. Participants were assigned a code number, which was drawn by a research assistant who had no access to pre-test results.

Operational definitions

Alzheimer's disease was operationalized as clinical evidence of AD based upon National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) criteria (McKhann et al, 1984). Depression or persistent depressed mood was measured by the Cornell Scale for Depression in Dementia (CSDD). A score of seven or higher (Alexopoulos, Abrams, Young, & Shamoian, 1988) was used to assess whether potential participants met criteria for depression. Outcomes related to dysphoria included mood, affect and level of depression. Mood was defined as a prolonged emotional state and was measured using the Dementia Mood Assessment Scale (Sunderland et al., 1988) and the Alzheimer's Mood Scale (Tappen & Williams, 1999). Affect was defined as the external expression of emotion and was measured by the Observed Affect Scale (OAS) developed by Lawton, Van Hailsma & Klapper (1996; Lawton, Van Haitsma, Perkinson & Ruckdeschel, 1999).

Participants

Eligibility criteria included: (1) residence in a long-term care facility; (2) clinical evidence of AD based upon NINCDS-ADRDA criteria (McKhann et al., 1984); (3) dependence in at least one of the following: bed mobility, transfers, gait or balance; (4) ability to walk with assistance; and (5) a CSDD score of seven or above. Potential participants who walked unaided for 30 minutes or more on their own were excluded. The study was approved by the University of Miami and Florida Atlantic University Institutional Review Boards as well as any participating nursing home that had its own review board. Written consent was obtained from next-of-kin or legal guardians prior to testing. Participant assent was determined on an ongoing basis. Residents of eight long-term care facilities in South Florida were screened for eligibility with the assistance of nursing home staff. If a family member or guardian was interested in participating and the resident met initial eligibility criteria, a research team member provided information regarding the study and requested consent. Any participants who showed evidence

of depression at pre-test but were untreated were brought to the attention of their primary healthcare providers as required by the Institutional Review Board.

Instruments

The CSDD is a 19-item 38-point observational instrument designed to rate depressive symptoms in individuals with dementia (Alexopoulos et al., 1988). The recommended cut-off score for mild depression is seven or higher. The CSDD has satisfactory inter-rater reliability (0.64–0.99) and satisfactory internal consistency (0.84). The instrument discriminates adequately between no depression, minor, probable major and major depression and evidenced significant correlation with Research Diagnostic Criteria (r=0.83) (Alexopoulos et al., 1988).

We measured mood with the Dementia Mood Assessment Scale (DMAS) (Sunderland et al., 1988) and the Alzheimer's Mood Scale (Tappen & Williams, 1999). The DMAS is a 24-item observational scale used to rate mood and functional abilities on an objective basis. Items 1–17 measure mood while the remaining items measure severity of dementia. Only items 1–17 were used in this analysis. The mood subscale has a maximum score of 102 with a higher score representing greater dysphoria. Sunderland et al. (1988) reported that scores were significantly correlated with global measures of depression (r=0.73) and sadness (r= 0.65) and inter-rater reliability was highly satisfactory.

The Alzheimer's Mood Scale is a 53-item Likert scale developed from a qualitative study of family and caregiver descriptions of the moods of individuals with AD (Tappen & Williams, 1999). Items represent the full range of positive and negative moods. We tested the scale in quantitative studies involving 150 participants with AD. Inter-rater reliabilities were in the 0.78–0.85 range. Results on the positive emotion subscale correlate well with the three positive items of Lawton's (1996) Observed Affect Scale (OAS) (r= 0.64) and negatively (r=−0.67) with the l0-item Montgomery-Asberg Rating Scale (MADRS). Results on the negative subscale correlate substantially with the MADRS (r=0.89) and the negative items of the OAS (r=0.88).

Affect was measured by the OAS developed by Lawton et al. (1996; 1999). The OAS measures three positive emotions (pleasure, interest and contentment) and three negative emotions (sadness, anxiety and anger). An observer rates the frequency of expression first over a ten-minute period of time and then over the last two weeks. For the 10-minute ratings, examiners observed residents during interviews on the nursing home units. We obtained information for the two-week ratings from resident records, reports from nurses and from nursing assistants involved in participants' care. Inter-rater reliability scores were satisfactory (0.76–0.89). Discriminant validity was evidenced by staff ratings showing that sad and anxious residents were less likely to be rated as showing pleasure and contentment.

Treatment

Interventionists provided treatment at nursing homes in individual sessions five days a week for 16 weeks. The length and frequency of exercise sessions were based on the recommendations of Healthy People 2010 (US Department of Health and Human Services, 2000). Sixteen depressed participants received comprehensive exercise, 17 received supervised walking and 12 were assigned to an attention-control group (social conversation). The length of the treatment session was progressively increased over four weeks until 30 minutes was reached. Participants were randomly assigned to one of three treatment groups:

Experimental group 1: Comprehensive individual exercise—Part One of the comprehensive exercise treatment consisted of ten minutes of strength, balance and flexibility exercises. Strength training included shallow knee bends, toe rises and push-pulls. Balance

exercises included side stepping first to the right, then left, then backwards and finally in circles. The number of repetitions progressed each week beginning with three per exercise and adding two repetitions each week up to nine repetitions. Part Two of the comprehensive exercise treatment consisted of walking. The walking component of the comprehensive exercise was progressed up to 20 minutes in duration.

Experimental group 2: Supervised individual walking—Walking pace was individualized according to the participant's ability. Participants were permitted to rest as needed. Sessions were progressed to increase time walked up to a maximum of 30 minutes. The interventionist used a gait belt and walked beside the participant lending assistance when needed. If the participant normally used an assistive device such as a walker or cane, they continued to use it during the walking sessions.

Attention control group—The participants in this group were engaged in casual conversation for an equivalent amount of time. Conversations occurred in the participant's room or in a nearby quiet setting at the nursing home. Therapeutically-oriented interaction including reminiscence and life review were avoided.

Procedures

Interventionists—Graduate nursing or physical therapy students trained and supervised by the investigators provided the intervention. The same interventionist worked with a participant throughout the 16-week period of intervention. The interventionist checked with the charge nurse for any change in condition that might preclude treatment and monitored vital signs before and after each exercise session. Interventionists met with investigators weekly to discuss participants' progress. On-site visits were made by an investigator periodically to observe sessions for quality and consistency.

Testers—Participants were tested by trained graduate research assistants blinded to treatment group assignments prior to initiation of treatment and at the end of the 16 weeks.

Adherence monitoring—Interventionists completed a treatment log after each session and recorded details of each exercise session including length of session in minutes, participant's response and explanations for any missed sessions.

Data analysis

Data were analyzed with SAS statistical software. Descriptive statistics, analysis of variance (ANOVA) and chi-square were used to describe the sample and to compare baseline status of participants in the three groups. A 3 × 2 repeated-measures analysis of variance was used to test the effects of exercise on mood and affect. Analysis of covariance was used to examine effects of any significant pre-test differences and differences in treatment intensity. Analysis was done on an intent-to-treat basis. Treatment intensity was measured by the total number of minutes of treatment actually provided over 16 weeks. When F ratios were significant, pre-planned contrasts were done to compare the treatment groups.

Results

Sociodemographics

Ninety-six nursing home residents with AD completed the parent study. Forty-five of these 87 met the criteria for this study. Baseline CSDD depression scores in this group ranged from 7–22; mean 12.4; SD = 4.65; median 11. These participants ranged in age from 71–101; mean 87.9; SD =5.95. Thirty-six (80%) were European American and nine (20%) were Hispanic. All Hispanic participants were tested in Spanish by bilingual research assistants. Their average

length of stay was 1,000 days with a range of 57–5860, median 836. Most were female (89%). The majority were ambulatory requiring either no assistance (26%) or minimal assistance (51%) to walk. Fifty-five percent used no assistive devices; 33% used a walker. Average MMSE score was 73; SD =6.19; median 7; with a range of 0–21. Twelve participants had a MMSE score of 0 or 1; only two had scores above 16. Characteristics of the sample are summarized in Table I.

Comparison of groups

Following pre-testing, nine individuals dropped out of the study. Of these nine, one was assigned to the comprehensive exercise group, six to the walking group and two to the conversation group. When we compared the dropouts across groups, the differences were not significant χ^2 (2, N = 54) = 2.9502; p = 0.2288).

There were no significant differences across treatment groups by age (F [2, 42] = 0.10; p = 0.9089), length of stay (F (2, 42] = 0.05; p = 0.9524) or CSDD scores (F (2, 42] =2.15; p = 0.1275) at pre-test using one way ANOVA. Mantel-Haenzel Chi-square analysis indicated no significant differences in gender across treatment groups χ^2 (3, N=45) = 1.3379; p=0.2474).

Despite random assignment to treatment groups, significant differences across treatment groups were found in baseline MMSE (F (2, 42] = 3.84; p = 0.0295) and in treatment intensity over the 16 weeks (F (2, 44] = 13.00; p = 0.0001) (see Table II)

Although large, the difference in treatment intensity between the conversation and exercise groups is not unexpected in this frail population, as even minor, short-term illnesses interfere with both ability and willingness to participate in exercise more than with ability or willingness to participate in conversation.

Outcomes

Inspection of the group means for the CSDD at pre- and post-test indicates that they dropped in all three treatment groups from baseline to post-test. The mean score for the sample as a whole dropped from 12.40 (SD=4.65); median 11 to a mean of 9.77 (SD = 6.73) and median 8. Likewise, the range of CSDD scores at baseline was 7–27 compared to post-test range of 0–24. At baseline, no participant had a CSDD score under 7 by definition as those in the parent study who had a score less than 7 were eliminated for purposes of this analysis. At post-test, 16 (35%) of the 45 participants had CSDD Scores under 7.

Changes were also found in the DMAS scores. Baseline mean for the sample as a whole was 31.93 (SD = 14.6); median 33, at post-test it was 28.62 (SD = 18); median 27. This change over time was significant (F (1, 43] = 15.70; p = 0.0003).

Similar results from baseline to post-test in the group as a whole were found on all except one of the remaining outcome measures. The OAS Negative Affect 10 Minutes (F (1, 43] = 4.82; p = 0.0335), OAS Positive Affect 10 Minutes (F [1, 43]= 16.88; p = 0.0002), OAS Positive Affect over two weeks (F [1, 43] =7.44; p= 0.0092), Alzheimer's Mood Scale Positive Mood (F (1.43]=20,90; p<0.0001) and Alzheimer's Mood Scale Negative Mood (F [1,43]=4.15; p=0.0487). All showed significant improvement. Only the OAS Negative Affect over two weeks was not significant (F [1, 43] =2.49; p=0.1217). Total group means, SD and ranges for each of these may be found in Table III.

Table IV shows means, standard deviations and change scores by treatment group. None of these analyses yielded evidence of greater improvement in either of the exercise groups over the social conversation group.

Further analysis was done controlling for the differences across treatment groups in baseline MMSE and in treatment intensity as well as the baseline depression, affect or mood score. Controlling for these baseline measures, we found significant differences over time by treatment group on two of the outcome measures: the OAS Positive Affect over 2 weeks and Alzheimer's Mood Scale Negative Mood Subscale (see Table V).

On the OAS 2-Week Positive Affect subscale, preplanned contrasts between treatment groups indicate the significant differences are between the comprehensive exercise and both the walking group (p=0.0314) and conversation group (p=0.0451). On the Alzheimer's Mood Scale Negative Mood Subscale, significant differences were found between the conversation group and both types of exercise, the comprehensive (p=0.0518) and endurance (p=0.0161) but not between the two types of exercise (p=0.6408). Inspection of the adjusted means in Table V indicates a pattern of greater improvement (less negative or more positive affect or mood) for both the comprehensive exercise and walking groups on all outcome measures with the exception of the OAS 10-Minute Positive Affect and Alzheimer's Mood Scale Positive Affect in which walking shows little advantage over social conversation.

Medications

At pre-test, 36% of participants received antidepressants, 25% were on anxiolytics and 22% received antipsychotic medication. Common antidepressants included paroxetine (Paxil), Sertraline (Zoloft), venlafaxine (Effexor). The most common anxiolytic was Lorazepam (Ativan); the most common antipsychotic was Risperidone (Risperdal). Twenty-two percent received two psychotropic medications and one person received three medications but 41% of the sample received none at all. Differences in number and type of psychoactive medications across treatment groups were not significant at baseline or at post-test and there was no significant change over time in the number of participants taking these medications. The correlation between depression scores as measured by the CSDD and total psychotropic medications prescribed did rise from r = 0.09 at pre-test to r = 0.42 at post-test, probably due to required reporting of pre-test depression findings to the staff.

Discussion

Exercise approaches to treatment of depression in nursing home residents with severe AD evidenced a clear benefit to participants in this study. Treatment of depression in persons with AD usually focuses on pharmacological rather than behavioural approaches. Almost half the participants in this study received no psychoactive medications at all. Since only 36% of participants were receiving anti-depressants and there were no differences in number or type of medications between treatment groups at either pre-test or post-test, use of anti-depressant therapy did not seem to explain the dramatic improvements from pre-test to post-test. This finding suggests an important role for behavioural approaches to treating dysphoric mood in AD.

The findings of this study are limited by the small sample size. More research with a larger sample is needed to clarify the relative benefits of different types of exercise and therapeutically and non-therapeutically oriented conversation in conjunction with or without pharmacological intervention. A higher intensity exercise programme with progressively increasing level of difficulty (as opposed to our approach of increasing the number of repetitions of the same strength, balance and flexibility building routine) may produce stronger results.

There was evident benefit of exercise over the attention-control intervention (social conversation) on some of the mood outcomes. Exercise was much more difficult to implement than social conversation in this population since illness frequently interfered with participation.

Chair-based exercise in which non-ambulatory individuals could participate should be investigated.

Social conversation, originally believed to be an attention-control, evidently had some beneficial effect although it may be necessary to provide much more of it than exercise to gain that effect. The social contact involved in all three groups may have been an important factor in the treatment of depression. In future studies of exercise, inclusion of a 'usual care' control group must be carefully considered.

Several areas for future research are suggested. Further study with a larger sample would permit comparisons of therapeutically-oriented and social conversation, aerobic versus strength training exercise and usual care. In our study, a combination of strength building, balance, flexibility and endurance was compared to endurance (walking) alone. The components of exercise (strength building, balance, flexibility and endurance) should be separated so that comparisons could be made. Confirmation of depression diagnoses with a clinical interview using DSM IV-TR criteria (American Psychiatric Association, 2000) is also recommended.

Exercise has well known benefits for individuals of all ages. This study suggests that we may add depressed nursing home residents with AD to the list of those who should exercise. Evidence for greater effectiveness of exercise over conversation is suggestive and needs further testing in a larger sample, preferably with both a 'usual care' control group and a more therapeutically-oriented conversation comparison group.

Nurses in long-term care facilities should advocate for exercise programmes designed for residents with dementia at all levels of severity. We recognize that financial constraints limit the availability of adequate numbers of personnel to implement exercise programmes. Although this study provides evidence of the benefits of exercise, future studies are needed to document the potential economic benefit of such interventions. Further studies are also needed to determine whether similar results could be obtained with a programme to train restorative aides and nursing assistants already employed in the nursing home settings.

Exercise programmes should include a variety of exercises targeting balance, endurance and upper and lower extremity strength not just simple walking. Since depressed residents with AD are unlikely to initiate exercise, nursing assistants must be trained to encourage residents to exercise. Many residents with advanced dementia cannot participate in group exercise programmes, therefore individual exercise is recommended for those residents.

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Table I

Baseline sociodemographic characteristics of sample.

		Total (*N* = 45)		
	%	**Mean**	**SD**	**Range**
CSDD[1]		12.4	4.65	7–22
Age		87.9	5.95	71–101
Length of stay (days)		1,000.07	967.36	57–5,860
MMSE		7.3	6.19	0–21
Gender				
Male	11			
Female	89			
Ambulatory status				
No assistance	25			
Minimal assist	52			
Moderate assist	23			
Ambulation aids				
No assistance	55			
Walker	33			
Other device	12			

[1] Cornell Scale for Depression in Dementia.

Table II

Treatment intensity.[2]

	Mean	SD
Exercise	753	407
Walking	802	577
Conversation	1537	181

F (2, 44) = 13.00. p= 0.0001.

[2] Number of minutes of treatment.

Table III

Affect and mood scales: Baseline and post-test means, standard deviations and ranges for depressed sample.

	Baseline (*N* = 45)			Post-test (*N* = 45)			Significant
	M	**SD**	**Range**	**M**	**SD**	**Range**	***P***
DMAS[3]	31.93	14.06	9–70	28.62	18.00	2–66	0.0003**
OAS-10 minute negative[4]	5.17	2.87	0–12	4.64	3.65	0–4	0.0335*
OAS-10 minute positive	7.73	2.91	1–12	9.06	2.79	2–12	0.0002**
OAS-2 week negative	6.90	2.93	2–12	5.71	4.00	0–12	0.1217
OAS-2 week positive	9.46	2.68	2–12	9.57	2.31	2–12	0.0092**
AMS Positive mood[5]	73.48	15.87	72–107	78.60	20.69	42–121	0.0001**
AMS Negative mood	66.51	13.25	41–101	58.55	18.97	0–97	0.0487*
CSDD[1]	12.40	4.65	7–27	9.77	6.73	0–24	0.0001**

*$p<0.05$.

**$p<0.01$.

[3]Dementia Mood Assessment Scale.

[4]Observed Affect Scale.

[5]Alzheimer's Mood Scale.

[1]Cornell Scale for Depression in Dementia.

Table IV

Means, standard deviations and change scores at baseline and post-test on outcome measures (*N*=45).

	Exercise	Walling	Conversation
DMAS[3]			
Baseline	32.93 (13.87)	26.94 (12.93)	37.66 (14.46)
Post-test	28.06 (16.64)	24.17 (17.81)	35.66 (19.27)
Change	−4.87	−2.77	−2.00
OAS[4] 10 minute negative			
Baseline	4.81 (2.19)	6.17 (3.22)	4.25 (2.95)
Post-test	4.00 (3.07)	4.88 (4.18)	5.16 (3.73)
Change	−0.81	−1.29	+0.91
OAS 10 minute positive			
Baseline	7.68 (2.21)	8.58 (3.24)	6.58 (3.05)
Post-test	9.50 (2.33)	8.58 (3.02)	9.16 (3.12)
Change	+1.82	0	+2.58
OAS 2 week negative			
Baseline	6.06 (2.97)	6.93 (2.86)	8.00 (2.86)
Post-test	5.18 (4.06)	5.47 (3.93)	6.75 (4.18)
Change	−0.88	−1.46	−1.25
OAS 2 week positive			
Baseline	9.31 92.15)	9.94 (2.35)	9.00 (3.71)
Post-test	10.37 (1.82)	9.23 (2.70)	9.00 (2.17)
Change	+1.06	−0.71	0
AMS positive subscale[5]			
Baseline	72.12 (10.83)	67.83 (17.75)	78.76 (17.64)
Post-test	79.81(17.15)	73.91 (19.73	80.70 (24.72)
Change	+7.69	+6.08	+1.94
AMS negative subscale			
Baseline	66.62 (10.28)	68.91 (13.05)	64.70 (16.09)
Post-test	58.62 (17.06)	65.16 (15.05)	53.82 (22.4)
Change	−8.00	−3.75	−10.88
CSDD[1]			
Baseline	12.18 (5.00)	11.05 (2.79)	14.58 (5.75)
Post-test	9.68 (6.57)	8.37 (5.78)	11.75 (8.10)
Change	−2.50	−2.68	−2.83

[3] Dementia Mood Assessment Scale.

[4] Observed Affect Scale.

[5] Alzheimer's Mood Scale.

[1] Cornell Scale for Depression in Dementia.

Table V

Comparison by treatment group outcomes controlling for baseline Status, baseline cognition (MMSE) and treatment fidelity (N = 45).

Outcome measure	Adjusted means			F	*P*
	Exercise	Walk	Conversation		
DMAS[3]	26.25	25.16	36.67	1.34	0.2747
OAS-10 Minute negative[4]	3.41	4.00	7.18	2.75	0.0762
OAS-0 Minute positive	9.99	8.10	9.18	2.35	0.1091
OAS-2 Week negative	4.99	5.26	7.56	.97	0.3875
OAS-2 Week positive	10.81	9.02	8.71	3.19	0.0500*
AMS-Positive subscale[5]	84.28	76.93	73.38	1.01	0.3744
AMS-Negative subscale	55.19	52.02	72.29	3.26	0.0492*
CSDD[1]	9.02	8.26	12.77	1.81	0.1777

p = 0.05.

[3]Dementia Mood Assessment Scale.

[4]Observed Affect Scale.

[5]Alzheimer's Mood Scale.

[1]Cornell Scale for Depression in Dementia.

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