The effect of a multisensory exercise program on engagement, behavior, and selected physiological indexes in persons with dementia

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Abstract

A multisensory exercise approach that evokes the stimulation and use of various senses, such as combining physical and cognitive stimuli, can assist in the management of persons with Alzheimer's disease (AD). The objective of this study was to evaluate the outcomes of a multisensory exercise program on cognitive function (engagement), behavior (mood), and physiological indices (blood pressure, resting heart rate, and weight) in 13 nursing home residents diagnosed with moderate to severe AD. A one-group pretest/post-test, quasi-experimental design was used. The program combined a variety of sensory stimulations, integrating storytelling and imaging strategies. Results showed an improvement in resting heart rate, overall mood, and in engagement of physical activity. The findings suggest that a multisensory exercise approach can be beneficial for individuals with AD.

Key words: multisensory exercise, Alzheimer's disease, cognitive function, storytelling, imagery

Introduction

A great number of persons with Alzheimer's disease (AD) are in institutional settings. At times, institutionalization limits an individual's ability to participate in physical exercise and other programs to promote health. Reduced physical activity is highly correlated with functional decline.[1] There is a need to design and study exercise programs to improve the health of individuals with AD. The benefits of exercise programs depend on the duration and intensity of participation.[2] Research evidence shows that exercise programs requiring prolonged and sustained duration at a moderate intensity level of physical exertion result in significant health outcomes in older adults.[3] "Moderate" refers to working at an intensity level above feeling comfortable and below feeling tired with the exercises.[3] Older adults' participation in physical activity programs has been linked to a number of positive physical and psychological outcomes.[4] Studies over the past decade have found a positive link between participation in structured exercises and improved function in persons with AD.[5-9] Research findings have shown that exercise helps improve behavior, cognition, and physical health for individuals with AD.[5,9-12]

Persons with AD display impairments in attention, in following instructions, and in communication due to central nervous system damage.[13] Some of these impairments are manifested in behavioral problems, such as apathy, agitation, and wandering, that lead to disengagement from planned activities, such as exercise programs.[14] Practitioners need to establish evidence to support strategies to increase motivation and engagement with this population. The author advocates a multisensory approach combining storytelling and imagery strategies to increase engagement in exercise. The author believes that persons with AD require more than just simple and direct exercise instruction; they need a multisensory approach that combines physical and cognitive stimulation therapies to facilitate their attention and engagement in the physical activity.

Multisensory stimulation activities are defined as approaches and strategies that stimulate the primary senses in a focused manner to promote more adaptive behaviors or adaptive environments and generate enjoyable sensorial experiences.[15,16] The sensory input is the stimuli reaching a person through sensory channels

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including arousal, olfactory, auditory, and touch. Rehabilitative professionals vary the type, duration, and intensity of the stimuli depending on their professional orientation and training and also their client's goals. For example, one rehabilitation therapist might use brushing, vibration, and stretching a muscle to facilitate movement and spinning and flashing lights to facilitate alertness and attention.[17,18] Another practitioner might use room redesign to promote a more adaptive and richer environment for older people with dementia.[19] Practitioners may also use communication, socialization, and exercise in the management and quality of care for persons with AD.[9-11,20] These approaches use single- or multiple-sensory/motor strategies to enrich the environment.[5,7,21,22] In 1966, Weil[23] reported the benefits of a multisensory approach for senile older adults. Other studies report that using this approach enriches the therapeutic environment, which promotes better communication, mood, attention, and intellectual function.[24-26] In 1967, Bower[27] reported a specific multisensory approach involving: listening to music, dancing, using watercolor slides, and drinking hot tea. Bower's approach coordinated the stimulation of all five senses, and he found that persons with AD experienced improved communication, emotional, and intellectual function.

It is also essential for physical exercise to promote meaningful, engaging, and pleasurable participation, in particularly with nursing home residents.[28]

Storytelling as strategy

Storytelling is the process of narrating incidents, events, and themes to stimulate engagement and participation in the rehabilitation, health, and prevention process. It evokes the stimulation and use of the senses. Storytelling has been used in clinical practice for different populations, from children to mature adults.[29] Clinicians and researchers view the storytelling process and themes as building blocks for personal identity and representations of personal meanings that enable personal connections.[30] The story can be a brief vignette, a case representation (such as taking roles in a story line), or themes with participatory action. Stories could simulate real life experiences or creative expressions of skills. Storytelling and listening to stories can prioritize listeners' personal meanings, values, and experiences. When a story is introduced and a theme built, listeners increase their attention and participation in the activity by enacting the story line through movements. A sample story line might be:

> "Let me tell you a story. Today, the Queen of England is coming to visit our home. We will prepare a nice dinner for the queen, but before that we need to clean, decorate, and cook for her. The queen is a nice and sophisticated lady, she . . . "

Advocates of storytelling strategies believe it is possible to create a more engaging and humanistic environment that also stimulates the emotional and memory systems.[31]

Imagery as strategy

Imagery is the process of developing a mental representation of persons, objects, or feelings. Imagery evokes the stimulation and use of various senses.[32] The mind's images trigger psychological processes and describe three important aspects of the individual's rehabilitation and intervention: the presentations of self, the representations of the world, and the representations of the future.[32] When someone is asked to imagine a movement and to make it as real as they can, they evoke the senses and create an experience by using past memories and images. When participants are asked to imagine a tranquil natural setting, they can actually increase their sense of well-being. Such mental imagery is used in sports,[33] cognitive-behavioral therapy,[34] and motor learning.[35]

The neuropsychological relationships between imagining and actually performing a movement have been experimentally demonstrated by techniques such as PET and fMRI that map brain activity.[35] The experimental psychophysiological studies showed that subjects simulated the production of certain mental images, which triggered a series of corresponding physiological modifications. Some of the somatic reactions identified as a direct consequence of guided imagery techniques were: increased heart rate, modified pupil size, increased level of glucose in the blood, and reduced muscular tension.[35] These findings support the idea that the cortical areas activated during imagery exercises are similar to those activated during actual performance.

Methods

Setting

This study intervention took place in a multipurpose room at a Memory Care Residence for persons with AD.

Participants

A convenience sample of 13 residents of a preliminary pool of 22 participated in the study. Inclusion criteria

specified that each participant must: be 65 years of age or older; have a medical diagnosis of dementia according to the criteria of the National Institute of Neurological and Cognitive Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA);[36] be able to use a wheelchair or ambulate with minimal assistance; have a score of 21 or less in the Mini- Mental State Examination (MMSE);[37] and provide informed consent, either by resident or guardian. Exclusion criteria specified that residents must have no acute medical conditions and no contraindications for exercise.

The sample consisted of 12 females and one male; all were Caucasians, middle class, and living in the facility. Their ages ranged from 70-93 (mean = 85.7, SD = 6.5). Their cognitive score, as measured by the MMSE, ranged from 1 to 12 (mean = 7.25, SD = 3.4), indicating moderate to severe cognitive impairment. The MMSE is a valid and reliable scale that scores cognitive impairment on a 1- to 30-point scale (1 being the lowest). A score of 21 or less indicates significant cognitive impairment.[37] Moderate to severe cognitive impairment was also found as measured by the Brief Cognitive Rating Scale (BCRS);[38] participants ranged from 3.6 to 6.8 (mean = 5.4, SD = .51). The BCRS uses a 1 to 7 scale, with 7 being the lowest. This instrument evaluates cognitive decline, regardless of etiology.

Instrumentation

Six outcomes were measured. Four outcomes—engagement, resting heart rate (RHR), blood pressure (BP), and weight—were measured before and after the intervention. Mood was recorded at the end of the multisensory program as a subjective measure, based on the perceptions of overall mood changes as rated by eight examiners: three family members, three caregivers, the activity director, and a student assistant. Overall mood rating was based on perceived changes in the participants' state of happiness, agitation, and friendliness after completing the program. Session length was recorded at all sessions. The eight examiners also completed the Menorah Park Engagement Scale (MPES version 2000) before and after the intervention. The facility's nurse collected anthropometric data.

The participants' engagement levels were measured using the MPES,[39] which uses a three-point scale, with three being the highest (1 = not engaged at all, 2 = engaged up to half of the activity, 3 = engaged more than half of the activity). This 12-item instrument measures the individual's participation in and reaction to the activity. The scale has been shown to achieve inter-rater agreement levels of more than 95 percent.[40]

The participants' overall moods were measured using the Caregiver Mood Report (CMR) questionnaire. This subjective questionnaire, developed by the author (without validity and reliability being established), evaluates the resident's overall mood by asking the examiner to rate three behavioral characteristics, as follows:

> "After completion of the multisensory exercise program, the participant: 1) is calmer, 2) sounds and looks happier, and 3) is friendlier."

The answers are based on a three-point scale (1 = no, 2 = a little bit, 3 = yes), with three being the highest. To avoid overload with the intervention assessments, the eight examiners rated residents' overall moods at the end of the program.

A video recording was used twice during the intervention to record facial expressions, eye contact, and singing. These supported the CMR raters' responses.

The facility's nurse measured RHR, BP, and weight. The nurse and staff were asked to report if significant changes occurred in medications, diet, schedule, and activities during the eight-week treatment. Participants' duration of adherence to the multisensory exercise sessions was recorded on a log sheet.

The multisensory exercise program

The multisensory exercise program was designed to increase enjoyment and participation. The goal was to keep residents involved with the exercises as long as possible. This program was a group intervention after lunchtime, three times a week for eight weeks. An exercise physiologist with training in gerontology conducted the program. The program's initial duration was 15 minutes and it increased to 70 minutes.

The multisensory exercise program consisted of four components: a focused attention and warm-up session, flexibility and aerobic exercises, a strength training session, and a closure session that focused on relaxation and breathing techniques.

The first component used storytelling and imagery, in combination with a warm-up session of seated exercises using soft music, to help participants connect with the activity and to prepare for faster, coordinated movements, as well as dual task performance (i.e., tapping feet and clapping hands). The trainer provided constant cueing to focus residents' attention on the exercises, along with movement imagery instructions to facilitate engagement. Examples included "do the movement," "hear the music," and "feel the story."

In the second component, an array of exercises directed movement for every major joint in the body.

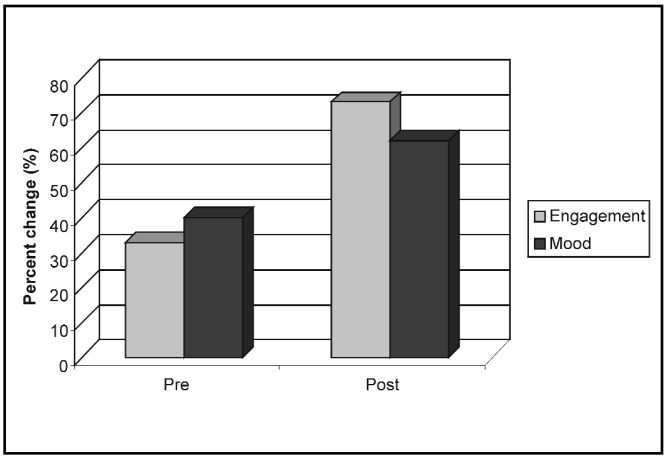

Figure 1. Pre- and post-response on participants' engagement level and mood.

The exercises included cycling with the hands, arm rolls, arm jumping rope movement, baking bread, cooking pizza, swimming, as well as imagery such as flying in the sky with the birds, marching in the fields of Ireland, and dancing on a tropical island.

The strength-training component used movements that: isolated large muscles, performed isometric contractions, and tested balance and endurance for upper and lower body. Thematic music and storytelling were continued in this session.

Analysis

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS, version 9.0). Changes for the baseline from pre- and post-scores were compared using paired t-test. All p values were based on two-tailed tests. This was done for RHR, BP, weight, and BCRS. Percentage estimates were analyzed for engagement and overall mood.

Results

The MPES showed that 69.2 percent (n = 9) of the participants had engaged in "more than half" of the activity, and 30.8 percent (n = 4) had engaged "up to half" of the activity (Figure 1).

At the end of the multisensory exercise program, eight residents (61.5 percent) were classified as showing positive improvements in their overall mood as demonstrated by a positive response on "Participant looks: 1) happier; 2) calmer; and 3) friendlier." Five residents (38.5 percent) were reported as showing no significant, or little, improvement in their overall mood.

RHR showed a significant improvement from a mean of 79.69 to a mean of 70.92, a mean decrease of 8.77 beats per minute ($t = 5.93$, $DF = 12$, $p = 002$, $p < .01$). No significant difference was found in BP and weight. A six-month follow-up for cognitive decline showed the BCRS scores remained stable, with a cognitive score range from 4.8 to 6.4 (mean = 5.72, SD = .44). Over the course of the study, the length of the 22 sessions was increased incrementally from 15 to 70 minutes (mean = 5.72, SD = .44). Residents achieved peak performance at four weeks. None of the participants had significant changes in their schedules as reported by the nurse during the eight-week treatment.

Limitations

This study was limited primarily by the lack of a control group and the lack of randomization. The use of a small sample of convenience does not allow generalization to other settings and populations. The engagement scale and the mood questionnaire measures require further validation.

Conclusions

State and federal governmental organizations have not yet properly addressed the institutionalized older adult's need for physical activity. The American College of Sports Medicine cites the benefits of exercise and has guidelines for exercise testing and programming for persons with 40 different diseases and disabilities.[41] However, investigations into the use of exercise with persons with AD have been limited. Many of the investigations are difficult to duplicate because of incomplete program descriptions or unclear protocols such as: the techniques used to effect compliance; the type of cognitive or behavioral intervention used; clear exercise instructions; specific identification of exercise duration and frequency; and qualifications and training for the exercise facilitator.

Further research is needed to determine the efficacy of this approach for reducing physical disability and cognitive decline and improving the quality of life for persons with AD. In addition, studies on exercise and AD need to specify exercise duration; to date, there is no suggested optimal duration for exercise programs for cognitively impaired older adults. Further research and duplication of this study under more rigorous conditions are recommended. The author is planning to duplicate this study at a different facility.

Regarding implications for practice, our preliminary findings suggest that multisensory exercise approaches may decrease RHR, increase exercise engagement, and preserve function in persons with AD.

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