<u>Original Research</u>

Analysis of Effect of Music and Art Combined with Kinect Game Therapy in Improving the Cognitive Function and Alleviating Negative Emotions of Alzheimer's Disease Patients in a Residential Aged Care Facilities

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ABSTRACT

Background • Alzheimer's disease (AD) is a major disease that affects neurological, cognitive, and memory functions in older adults, and care for AD patients needs to be more specialized and targeted.

Objective • To analyze the effect of music and art combined with Kinect game therapy as a special care on improving cognitive function and alleviating negative emotions in AD patients in a nursing facility.

Methods • One hundred AD patients admitted to a residential aged care facility in Changsha, Hunan Province, China, from December 2020 to December 2022, were selected as the study subjects. They were divided into the observation group (OG; n=50) for special care of music art combined with Kinect game therapy and the control group (CG; n=50) for conventional care. The activities of daily living scale (ADL) and mini-mental state examination (MMSE) were used to assess the neurological and cognitive functional changes in the two groups before and after the nursing intervention. The

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INTRODUCTION

Alzheimer's disease (AD) is a degenerative disease of the central nervous system characterized by progressive cognitive dysfunction and behavioral impairment, which is extremely common in the elderly.¹ According to statistics, the prevalence of AD is as high as 30-50% in people over 70 years of age and reaches about 70% in people over 80 years of age.² The onset of AD is insidious, and its etiology is still unclear. It is believed to be mainly caused by environmental and genetic factors.³ The main manifestations of AD are memory impairment, aphasia, loss of use, loss of recognition, executive

Pittsburgh sleep quality index (PSQI) and self-rating scale of sleep (SRSS) were used to assess the quality of sleep in both groups, and the GQOL-74 scale was used to evaluate the quality of life before and after the intervention. The negative emotions were tested by the self-rating anxiety scale (SAS) and self-rating depression scale (SDS). Finally, patient satisfaction with the care was investigated.

Results • After the nursing intervention, scores of ADL, PSQI, SRSS, SAS and SDS of the OG were lower compared with the CG, while MMSE and GQOL-74 scores were higher (P < .05). The results of the nursing satisfaction survey were also higher in the OG than in the CG (P < .05). **Conclusion** • The combined music and art therapy with Kinect game therapy in elderly institutions can effectively enhance AD patients' neurological and cognitive functions, improve their sleep and quality of life, and alleviate negative emotions. (*Altern Ther Health Med.* [E-pub ahead of print.])

dysfunction, and personality and behavioral changes.⁴ In elderly institutions, AD patients are a priority group that deserves attention. As there is no cure, AD patients need to be given a combination of long-term pharmacological, non-pharmacological, and careful care to delay the progression of their disease.⁵ Currently, care for AD is still in the exploratory stage, and traditional care is often provided in the form of home, community care or a combination of these. Still, the results are not satisfactory.⁶ Improving the quality of care for AD patients is the hotspot and difficult point of modern clinical research.

Music and art therapy is an emerging fringe discipline based on theories and methods of psychotherapy, which uses musical characteristics to design musical behaviors to help patients eliminate psychological barriers and promote physical and mental health.⁷ Current research has confirmed that music and art therapy can promote the recovery of cognitive and memory functions in patients with cerebrovascular disease after surgery.^{8,9} Recently, somatosensory Kinect games have also been introduced into

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the field of clinical rehabilitation to help patients improve their motor and cognitive functions by recognizing the human body structure and representing patients' movements through game characters and using the fun of the games to promote daily living abilities.^{10,11}

However, this therapy has been used less frequently, and there is little research on the care model combining music and art. Therefore, we analyzed the effect of music and art combined with Kinect game therapy on improving cognitive function and alleviating negative emotions in AD patients in nursing institutions to provide effective guidance for future clinical application. Below are the details of the study.

MATERIALS AND METHODS

Research objects

The study subjects were 100 cases of AD patients admitted to a residential aged care facility in Changsha, Hunan Province, China, from December 2020 and December 2022. Outcome measures. They were to an observation group (OG) and a control group (CG) (n=50) treated with the special care of music art combined with Kinect game therapy and conventional care, respectively. This is a retrospective study approved by the Ethics Committee of Hunan University of Chinese Medicine, The Declaration of Helsinki was strictly followed during the research, and all study subjects signed informed consent forms by themselves.

Inclusion and exclusion criteria

Inclusion criteria: Complete clinical profile; confirmed diagnosis of AD.¹² Age>60 years, self-consciousness and normal limb movement; mental status symptoms, no depression. Exclusion criteria: Other major diseases, including tumors; people with vascular dementia or dementia from other causes; encephalitis, epilepsy; serious abnormalities of the heart, liver and kidneys; patients who have stopped the trial for various reasons; patients with severe cognitive and memory dysfunction and those who are unable to communicate normally.

Nursing methods

In the CG, conventional nursing interventions were given. The nursing staff instructed patients to take medication daily and provided AD-related knowledge explanation and related training. The patients were trained to improve memory function by recalling and asking about what happened in the short term, encouraged to read newspapers and books aloud to train their language function, and asked to perform some simple addition and subtraction calculations and sorting to exercise their thinking ability. Besides, the patient's emotional changes in their daily lives were closely observed, and timely interventions were given to relieve their negative emotions. Furthermore, a balanced diet was ensured to help reduce their symptoms. OG: The OG used music art combined with Kinect game therapy. In addition to daily and regular instruction on medication, patients received Kinect game therapy. Using the Kinect body sensing device, patients were instructed to control

the game with body movements, and simple games were used to promote active movement to improve motor function and balance. At the same time, the game scenes were transformed to train patients' ability to change their thinking, promote their movement through the game mode, improve their reaction ability, and promote functional recovery. Meanwhile, daily music therapy was combined with selecting suitable types of music according to patients' personal preferences. The adoption of programs such as music listening, reminiscence, and singing were used to help patients relax their bodies and minds. Also, music was used to evoke past events, and the nursing staff was patient with the patients and encouraged them to help facilitate physical and mental recovery. Patients in both groups received rehabilitation care for 2 months, and investigations were conducted before and after the nursing intervention.

Outcome measures

The activities of daily living scale (ADL)¹³ and the minimental state examination (MMSE)14 were used to assess the changes in neurological and cognitive function in both groups before and after the nursing intervention, respectively, with lower ADL scores indicating better neurological function and higher MMSE scores suggesting better cognitive function. The Pittsburgh sleep quality index (PSQI)¹⁵ and self-rating scale of sleep (SRSS)¹⁶ were used to assess sleep quality before and after the intervention in both groups, and higher PSQI and SRSS indicated poorer sleep quality in patients. The GQOL-74 scale¹⁷ assessed the changes in quality of life before and after the intervention in both groups, including four dimensions of physical, psychological, social, and material functioning, with higher scores indicating a more desirable quality of life. The negative emotions of patients in both groups before and after the intervention were assessed by the self-rating anxiety scale (SAS) and self-rating depression scale (SDS),¹⁸ with lower SAS and SDS indicating better emotions of patients. Our institution's own scale was used to count patients' satisfaction with nursing interventions, and the results were classified as very satisfied, basically satisfied, and dissatisfied, with total satisfaction = (very satisfied + satisfied)/total number × 100%.¹⁹

Statistical analysis

The data results were statistically analyzed by SPSS 23.0 software (International Business Machines Corporation, USA) and visualized by GraphPad Prism 9 software (GraphPad Software, USA). The counting data are expressed as (%) and compared by the chi-square test. The measurement data were expressed as $(\overline{x \pm s})$; a *t* test was used for comparison between groups, and a paired t-test was used for that before and after the intervention. P < .05 denoted that the difference was statistically significant.

RESULTS

Basic data of patients in both groups

The comparison of the basic data such as age, gender, body mass index (BMI), education level, and ethnicity of the

Table 1. Basic data of patients in both groups

					Education Level	
			Gender		College and above / junior	Ethnicity
		Age	Male /	BMI	high school, high school /	Han Chinese
Group	n	(years)	Female	(kg/m^2)	elementary school and below	/ Minority
Observation	50	720127	28(56.0%) /	261116	12(24.0%) / 25(50.0%) /	50(100.0%) /
group	50	/3.0±3./	22(44.0%)	20.1±1.0	13(26.0%)	0(0%)
Control	50	726127	30(60.0%) /	25.0 1.1.4	9(18.0%) / 27(54.0%) /	48(96.0%) /
group	50	/2.0±3./	20(40.0%)	25.9±1.4	14(28.0%)	2(4.0%)
χ^2/t		0.541	0.164	0.665	0.543	2.041
Divalua		500	695	508	760	152

Table 2. Comparison of nursing satisfaction

Group	n	Very satisfied	Satisfaction	Dissatisfaction	Total satisfaction
Observation group	50	30 (60.0%)	18 (36.0%)	2 (4.00%)	96.00%
Control group	50	22 (44.0%)	19 (38.0%)	9 (18.00%)	82.00%
χ^2					5.005
P value					.025

patients in the OG with those in the CG manifested that there was no statistical difference between them (P > .05), which confirmed the comparability between the two groups (Table 1).

Neurological and cognitive function changes

Before the intervention, comparing the results of ADL and MMSE scores between the two groups showed no statistically significant differences (P > .05). But, after the intervention, the ADL scores decreased in both groups, with lower OG scores than the CG (P < .05). While the MMSE scores were higher than before the intervention, and those were even higher in the OG (P < .05) (Figure 1).

Sleep quality changes

Before the intervention, PSQI and SRSS were similarly not different between the two groups (P > .05). While after the intervention, PSQI and SRSS reduced significantly in both groups than before the intervention and were lower in the OG compared with the CG (P < .05) (Figure 2).

Quality of life changes

The results of GQOL-74 scores were not different between the two groups before the intervention (P > .05); the scores of the four dimensions of physical function, psychological function, social function, and material function were further increased in the OG after the intervention compared with the CG (P < .05) (Figure 3).

Mental state changes

SAS and SDS assessment of the changes in the psychology of both groups of patients showed no statistical difference in SAS and SDS scores before the intervention (P > .05). Reduced SAS and SDS scores were found in both groups after the intervention, with even lower scores in the OG (P < .05) (Figure 4).

Comparison of nursing satisfaction

The nursing satisfaction survey results showed that the OG's total satisfaction was 96.00% and that of the CG was 82.00%. The total satisfaction of nursing in the OG was higher than that in the CG (P < .05) (Table 2).

Figure 1. Neurological and cognitive function changes. A. Comparison of ADL scores. B. Comparison of MMSE scores.



Note: # and & indicate statistically significant differences between the preintervention and observation groups (P < .05).

Figure 2. Sleep quality changes. **A.** Comparison of PSQI. **B.** Comparison of SRSS.





Figure 3. Quality of life changes. **A.** Comparison of physical functioning scores. **B.** Comparison of psychological functioning scores. **C.** Comparison of social functioning scores. **D.** Comparison of material functioning scores.





Figure 4. Mental state changes. A. Comparison of SAS. B. Comparison of SDS.



Note: # and & indicate statistically significant differences between the preintervention and observation groups (P < .05).

DISCUSSION

The effectiveness of the application of both music art therapy and Kinect game therapy has been demonstrated,²⁰ but there have been few studies on their combined use to design a special care model for AD patients. By combining music art therapy and Kinect game therapy, this study provides a new way for future AD rehabilitation therapy and a reliable reference and guideline for the clinical use of the combination therapy.

In this study, we found that after the special nursing intervention of music and art combined with Kinect game therapy, the neurological and cognitive functions and the quality of sleep and life of patients in the OG were significantly improved. This suggests that music and art combined with Kinect game therapy can improve the recovery of AD patients more effectively and enhance their ability to take care of themselves. In previous studies, we also found consistent results with the application of music art therapy and Kinect game therapy in COPD and stroke,^{21,22} which can corroborate the accuracy of the results of the current study. It is well known that damage to cholinergic neurons in AD patients reduces choline acetyltransferase (ChAT) and acetylcholine in the cerebral cortex and hippocampus, causing disturbances in circadian rhythms, which are also thought to be the biological basis for abnormal nocturnal behavior.^{23,24} Music has been shown to stimulate acetylcholine secretion in the brain, soothing human tension and regulating mood and stress.²⁵ Music can also promote the secretion of melatonin, which modulates sleep.²⁶ Thus, the use of music and art therapy not only helps to improve the quality of sleep of AD patients but also can reduce psycho-behavioral symptoms. In the meantime, the reduction in nighttime behavior can improve caregiver stress to a certain extent, which is of great application in elderly care facilities. On the other hand, we believe that music and art therapy can create a safe and relaxing environment for AD patients, enabling patients to view their disease more ideally and improving compliance in rehabilitation care. It also reduces patients' stress response, relaxes them, reduces the negative effects caused by adverse psychological factors, and promotes the simultaneous recovery of their orientation and language functions. This is also confirmed by comparing the SAS and SDS results of the two groups of patients.

The positive effect of Kinect game therapy, we believe, is mainly reflected in the improvement of the physiological functions of patients. Studies have shown that Kinect game therapy can enhance motor and balance functions in patients^{27,28}: in the game, patients improve thought transformation and problem-solving skills by choosing different game scenarios. Movement planning and organization were trained by changing posture to respond to changes in the environment during the game. Moreover, patients should subconsciously control the strength of the active and antagonistic muscles during the game, which is important for strengthening their muscle strength. As the body moves from side to side, the patient's head also moves from side to side, reinforcing three-dimensional spatial motor sensory stimulation and improving balance function. The large muscle groups of the human body, by participating in the aerobic exercise with moderate intensity activities, can improve the body's ability to inhale, transport and use oxygen, stimulate the pituitary gland to secrete β -endorphins, and improve the responsiveness of the central nervous system to enhance the body's tolerance to stimuli.²⁹ At the same time, the recreational nature of the game increases blood flow and oxygenation to the damaged area. It stimulates patients' nerves with the establishment of new cognitive neural networks, thus promoting functional recovery.³⁰ As a video game, the entertaining and immersive nature of the somatic game Kinect generates the initiative and enthusiasm of patients for rehabilitation exercises. It greatly improves the compliance of AD patients to participate in rehabilitation training, which can guarantee the rehabilitation of patients in the long run for AD that requires long and continuous rehabilitation training.

Finally, the improvement in nursing satisfaction of patients in the OG was also expected after the special nursing intervention of music art therapy and Kinect game therapy. The results also suggest that the use of music art therapy and Kinect game therapy for special care is not only more helpful to the recovery of AD patients, but also improves their overall rehabilitation experience, which is also important for the future improvement of the overall quality of health care services in elderly institutions.

Nevertheless, due to the limited study conditions, the number of cases included in this study is still small, so the results may have certain contingencies. Besides, the short research period results in the inability to assess the long-term prognostic improvement of patients for the time being. Finally, there are no uniform guidelines for the combined music and art therapy with Kinect game therapy. Hence, there may still be some room for optimization and improvement, and we will follow up with a more in-depth and comprehensive analysis of the above limitations.

CONCLUSION

The combined music and art therapy with Kinect game therapy can effectively enhance AD patients' neurological and cognitive functions, improve their sleep and quality of life, and alleviate negative emotions. The implementation of music art therapy and Kinect game therapy in nursing institutions is more helpful to the rehabilitation of AD patients and improves their overall rehabilitation experience, which has high application significance. However, due to the small number of cases in this study and the short study period, we still need to include more subjects and extend the study period to further validate these results.

ETHICAL APPROVAL Not applicable.

CONSENT TO PUBLISH

All authors gave final approval of the version to be published.

COMPETING INTERESTS

The authors report no conflict of interest

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AUTHOR CONTRIBUTIONS

Chunyan Li conceived and designed the project and wrote the paper. Chunyan Li generated the data. Pan Li analyzed the data. Pan Li modified the manuscript. All authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

AVAILABILITY OF DATA AND MATERIALS

The data supporting this study's findings are available from the corresponding author upon reasonable request.

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