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Verification of The Effect of Cognitive Training by Dance

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Abstract

Introduction: *Our preliminary trial revealed the correlation between cognitive ability and active ability, blood vessel age, and stress. From this result, a method to eliminate stress and favorably influence blood vessels and activity capacity was examined. We developed a method where elderly participants danced to familiar music while executing brain training tasks.*

Methods: *Verified method is a brain training developed from music therapy and dance. As brain training, the effectiveness of training tasks such as dual-task (performing two tasks simultaneously) and n-back task (recall task for items shown n steps earlier) have been verified. Additionally, methods developed in this study utilized "ostinato", a rendition often used in music such as folk music. This method repeats a short phrase multiple time. As it has a trait which makes it easy to retain and recall, a repeated melody which speeds up is easily retained in memory. Analysis in that is a comparison between intervention and control. Cognitive tests and stress checks were compared with a paired One-way analysis of variance.*

Result: *Data of 102 people were analyzed. In comparison to the control group, cognitive function was improved and distress was reduced in the intervention group. Scores of cognitive test items: immediate memory and recall delayed memory were significantly improved ($p < 0.05$).*

Conclusion: *The brain training dance to familiar music improved cognitive abilities. This activity can relieve stress. Following this study, we want to evolve the brain training dance that elderly in various conditions can do and increase the volume of fun activities available to the elderly.*

Keywords: Cognitive training; Dance; Stress; Elderly

Introduction

Progression prevention is the focus of the intervention, as Alzheimer's disease still has no fundamental therapeutic agent developed [1,2]. Our preliminary trial revealed the correlation between cognitive ability and active ability [3], blood vessel age, and stress [4]. From this result, a method to eliminate stress and favorably influence blood vessels and activity capacity was examined. The most familiar exercise to us is a dance and we can expect improvement of leg strength. Furthermore, dance to be effective also in the storage capacity have been suggested [5].

In addition, the relevance between music and memorization is known [6] that music encourages the recollection of memories [7-9], and moreover it promotes the maintenance of the memories [10-12]. Furthermore, sound and rhythm improves the encoding capability of people's memory, which is to recognize the lyrics [13]. Moreover, it has been verified lyrics accompanied with sound or rhythm are stored easily by the memory, but difficult to remember when without sound or rhythm [14]. Particularly, the method called ostinato, which is to repeat the rhythm and the phrase, especially makes it unforgettable and is often contained in the music that beats time with using hands or legs [15,16].

From this result, we developed a method where elderly participants danced to familiar music while executing brain training tasks. It was hypothesized that combining rhythmic dance with repeated memory tasks would improve memory performance (refer to figure 1). This method incorporates dual-task and n-back task whose effects have been verified. In previous studies conducted on brain training, the effectiveness of the n-back task (a delayed recall task for items shown n steps earlier) was verified. Meta-analysis results showed activity in the frontal lobe and parietal cortex area [17,18].

The brain has been reported to be more active during dual-task (performing two tasks simultaneously) than single-task (one-task activities such as exercise only, learning only) and activity in the anterior cortex has been verified [19, 20]. Based on these previous studies, synergistic effect was expected in combining n-back task and dual-task in this study experiment.

It was also predicted that stress associated with memory tasks would be alleviated by the relaxing effect of music. The fact of music as the response to stress, the decrease in the stimulation of anxiety, anger, or the sympathetic nerve

is verified [21]. The purpose of this study is to verify a new training method combining rhythmic dance and repeated memory tasks. An intervention study was conducted over 3 months, and compared results from the intervention group and the control group.

- Pre-memory tasks: Memory of 10 words
- Memory task in dance: Memory of lyrics and choreography
- Dance and interaction: Interacting with others by dance
- Delayed playback task: Play memory tasks during and after dance

Figure 1: Cognitive training using dance.

Method

Target cohort: 162 elderly people who applied for dance therapy to prevent dementia advertised by public relations.

Study period: April to September 2017.

Evaluation and analysis:

Measurement of cognitive function

A ten-word memory test measured immediate memory and recall delayed memory, each 10-point scale. A code conversion test: 75- point scale and Memory of animal name: 50- point scale.

The check of stress

Alpha- amylase levels of saliva taken from the sublingual gland were measured to measure eustress and distress. As shown in Figure 2, sympathetic nerve activity is reflected. Unpleasant stimulation causes levels to rise and pleasant stimulation causes it to decrease. Eustress and distress were measured in 30 seconds using saliva. The standard values of α-amylase levels in saliva from the sublingual gland; according to NIPRO, the manufacturer of the α-amylase test kit, are as shown in (Table 1).

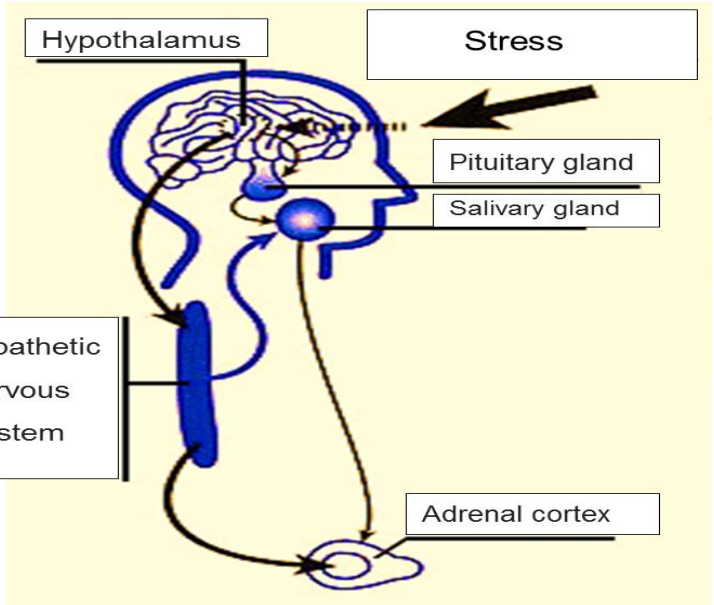

Figure 2: Mechanism of amylase secretion into saliva.
Authority: NIPRO

0-30 KU/L	There is no negative stress.
31-45 KU/L	There is slight negative stress.
46-60 KU/L	There is negative stress.
61 KU/L or more	There is a high amount of negative stress.

Table 1: The Reference values of salivary α- amylase.
Authority: NIPRO

Analytical method

The method of analyzation: We compared the score of evaluation of cognitive function and the amount of sublingual salivary amylase that is before intervention, during the 3 months of non-intervention, and after the intervention through the use of one-way analysis of variance (ANOVA).

Ethical considerations

The outline of the research, voluntary nature of participation, anonymity, and agreement regarding the publication of the document were explained to prospective participants both in writing and verbally, and their consent was subsequently obtained.
The study protocol was approved by the ethical review board of Nara Medical University.

Conflict of interests

In this research, we conducted this research by the cooperation of Japan Street Dance Studio Association, but we do not have the conflict of interests.

Result

Among the 162 participants, data of the 102 that participated until the end were analyzed. The average age of the subjects is 75 ± 8.2, with 23 being male and 79 being female. 54 participants were divided into intervention groups and 48 were nonintervention groups.

As shown in the figure, in one-way analysis of average score of cognitive tests, total of immediate memory (F = 3.75, p = 0.01) and recall delayed memory (F = 6.48, p = 0.00) were significantly improved.

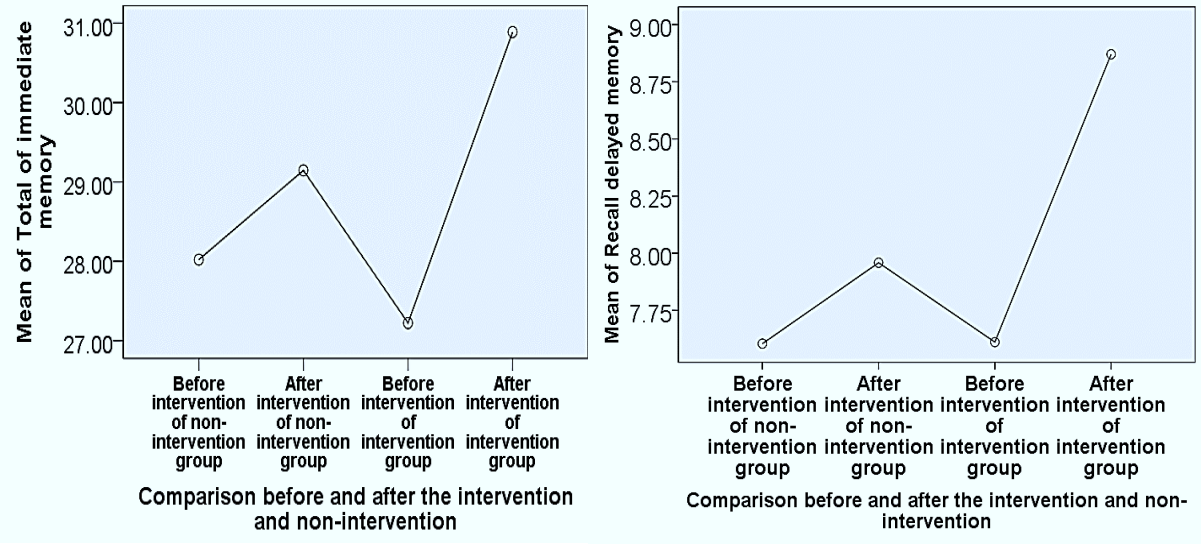

Figure 3: Comparison before and after the total of immediate memory and recall delayed memory.

In the multiple comparison using Tukey, both the immediate memory (p = 0.009) and the recall delayed memory (p = 0.001) had significant differences between the scores before and after the intervention group.

For other items, there was no significant difference, but the score of the code conversion test improved after intervention. There was no change in the memory of animal name (Figure 4).

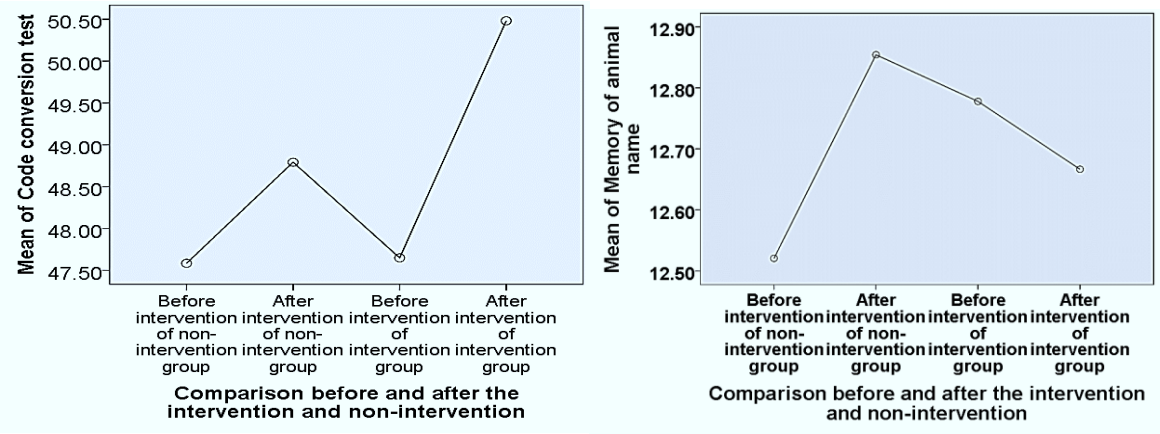

Figure 4: Comparison before and after the code conversion test and memory of animal name

Next, with regard to the results of sublingual salivary α amylase, the non-intervention group was 43-48, and it remained under stress. In contrast, the results of the intervention group were reduced to 30.5 and improved to a state with almost no stress. As shown in the figure 5, in one-way analysis of average score of sublingual salivary α amylase was significantly improved (F = 5.25, p = 0.02).

In the multiple comparison using Tukey, there was a significant difference between the nonintervention period and after the intervention (p = 0.030)

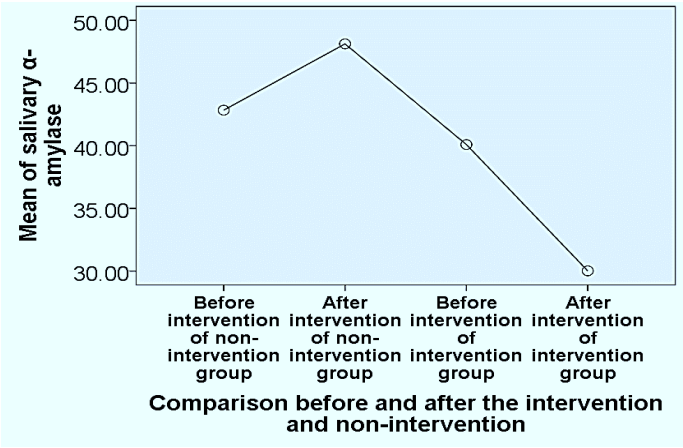

Figure 5: Comparison before and after α amylase in the saliva (stress level)

Discussion

The preventive intervention for AD implemented by each health organizations are still in the process of trial and error, and thus the development of effective techniques is an urgent issue. It is notable in this method that the combination of dance with the cognitive-training tasks resulted in the improvement of cognitive functions and even the stress reduction. This has the characteristic that by memorizing along with the music, we can easily memorize and recall the phrases or the movements. Lyrics indicated by songs can be remembered much better than clauses indicated by speech [14]. In addition, among the memory recall tests the group that done musical training scored better than the group that did not do the training. Moreover, the MRI showed that the domain of the brain was wider of the group that did the musical training and the possibility in the improvement of the cognitive function is suggested [22]. Therefore, it was predicted that the effect of brain training will be enhanced through the use of the memory promoting effects of rhythmic phrases with dance. Indeed, improvement of significant memory in this intervention was observed.

Additionally, this cognitive training using dance can also obtain the effects of exercise via dance. Exercise prevents several chronic diseases: cardiovascular disease, diabetes, cancer, hypertension, obesity, depression, osteoporosis and premature death [23], improves sleep quality and enhance vitality during the day [24-26]. What is further emphasized is that health and memory ability of the brain is improved [27-29], improving cognitive function in synergy with cognitive training. Exercise further reduces stress, anxiety and depressed feelings [30-32], so synergy is experienced in combination with music relaxation. This intervention is backed by the results of previous research, which as expected, greatly improved memory ability.

Next, in our preliminary survey, there was a negative correlation between stress and cognitive function, and the cognitive score was low when stress was high. From this result it is thought that it is necessary to reduce stress in order to improve memory ability and it is suggested that relaxation effect [33,34], which is caused by the music shows a positive impact on our memory. Many of the intervention that uses the help of music, has the purpose of exercising by moving along with the rhythm, like TV gymnastics, but it is also said that not only do they have physical effect, but also mental effects [35]. Although continuous brain training was accompanied by stress in some cases, distress was significantly reduced instead, using the method in this study. It can be inferred that music influenced recovery from fatigue [36].

Also, in the prior research, dance has been shown to improve mental health [37]. It has also been suggested that dance activates the basal ganglia network and improves motor function, cognitive function and mental condition [38]. Dancing has the benefit of triggering positive emotions [39], improving self-esteem and coping ability [40], improving the sense of psychological well-being, and improving depression by reducing anxiety [41]. It is thought that such an emotional effect mitigates stress when executing a memory task. Furthermore, by using familiar music, it has the effect of triggering recollections, and elderly people can obtain psychological satisfaction by looking back nostalgically [42].

The method developed in this study combines brain training with dance. It is a technique that repeats a short phrase and choreography multiple times. There is a characteristic that phrases can be easily reproduced.

As it has a trait which makes it easy retain and recall, it is easy to recall during memory and recall tasks when incorporated into these activities. Music can also help recollecting memories and through this, recalling memory and emotional activity can both be anticipated. Furthermore, maintaining and improving the cognitive function requires stress reduction. For the reason, it will be meaningful to progress with the intervention of the cognitive function improvement and stress relief at the same time, and the development of this program should be addressed continue.

Conclusion

We verified the effect of the method of cognitive training, which memory task was combined with dance, and found that there was a significant improvement in the cognitive function. In addition, by using this method, there is a benefit that the memory training can be conducted non-stressfully for the elderly people. Future task is to continue and expand this method.

Acknowledgement

We would like to thank all the elderly people for participating in the preventative care project. I would like to express my sincere gratitude to the chairman and others of the autonomous association who cooperated in the publicity. In this study, we have demonstrated the effect of cognitive training by dance. We seek to provide preventative care programs on the basis of the results and to improve subjects' benefits.

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