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Research Article

Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia

Mizue Suzuki, RN, PHN, PhD,[1] Masao Kanamori, MD, PhD,[2] Motoko Watanabe, RN,[3] Shingo Nagasawa, PhD,[4] Emi Kojima, CP,[5] Hajime Ooshiro, MD PhD,[5] and Daiichirou Nakahara, PhD[6]
[1]*School of Nursing, Mie Prefectual College of Nursing, Mie,* [2]*Biwako Seikei Sport College, Shiga,* [3]*Former Graduate School of Nursing, Hamamatsu University,* [4]*Yanaihara Institute,* [5]*Totomi Hospital,* [6]*School of Medicine, Hamamatsu University, Shizuoka, Japan*

Abstract The present study investigated the effectiveness of music therapy for dementia patients using endocrinological and behavioral evaluations. The study comprised 10 patients with senile dementia who received music therapy; six had Alzheimer's dementia and four had vascular dementia. Music therapy was performed twice a week for 8 consecutive weeks (16 sessions). As a result, total scores on the Mini-Mental State Examination (MMSE) did not significantly change, but the scores of a subscale, 'language', improved significantly. According to the Multidimensional Observation Scale For Elderly Subjects (MOSES), scores for 'irritability' decreased significantly. Regarding changes in salivary chromogranin A (CgA) levels, the average was significantly decreased before session 16 compared to after this. These results suggest that the combination of endocrinological measurements, behavioral evaluations and functional assessment methods are useful in evaluating the effects of music therapy in persons with senile dementia.

Key words elderly patients, evaluation, music therapy, senile dementia.

INTRODUCTION

Longevity is a characteristic of Japanese society. In 2002, people over 65 years of age constituted approximately 17.5% of the population. The elderly population in Japan continues to increase and is predicted to reach 32.3% by 2050. Because the prevalence of dementia and the number of bedridden elderly are anticipated to increase along with the care burden for families, Japanese public care insurance commenced in 2000. Recently, music therapy and music activity programs have been introduced into day-care centers for the elderly with dementia who use care insurance in Japan. It has been observed that patients with severe dementia remember old songs from childhood, and the agitation observed in dementia patients decreases through use of these old Japanese songs in clinical practice. In recent studies, psychosocial programs for dementia care that incorporate such activities were shown to decrease the prevalence of behavioral disorders among these patients (Gerdner & Swanson, 1993; Ragneskog *et al*., 1996; Thomas *et al*., 1997; Clark *et al*., 1998). Music therapy is based on reflection of emotions, memories and images that evoke experiences associated with the musical stimuli. Music acts as a powerful catalyst for precipitating memories. Gerdner and Swanson (1993) reported that music therapy decreased agitated behavior in confused elderly patients with dementia. The rhythm, harmony, melody of music, and singing familiar nostalgic songs induced an emotional reaction and stimulated cognitive and psychological functions. Previous research has found the effects of music on dementia patients includes decreasing agitated or aggressive behavior (Clark *et al.*, 1998; Gerdner, 1999), and improving sleep patterns (Lindenmuth, 1992) and nutritional intake (Ragneskog & Kihlgren, 1997). According to Kumar *et al.* (1999), increased levels of melatonin following music therapy contribute to the relaxed and calm mood in

Correspondence address: Mizue Suzuki, Mie Prefectual College of Nursing, 1-1-1 Yumegaoka, Tsu, Mie 514–0116, Japan. Email: mizue.suzuki@mcn.ac.jp
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patients with Alzheimer's disease. McKinney *et al.* (1997) reported the effects of music on mood and serum cortisol levels in healthy adults. Miluk-Koasa *et al.* (1994) also reported on the effects of music treatment on salivary cortisol in patients exposed to presurgical stress. Hall and Buckwalter (1987) pointed out that cognitive impairment resulted in decreased ability to receive and process sensory stimuli, and a progressively lowered the stress threshold. Subsequent dysfunctional behavior occurred when this threshold was exceeded. Using the mid-range theory, Gerdner (1999) hypothesized that individualized music therapy that had personal references would decrease behavioral symptoms and stress for patients with dementia by eliciting positive feelings and memories. Gerdner theorized that individualized music would have a soothing effect on dementia patients, which in turn would prevent or alleviate agitation. However, the relationship between stress and behavioral problems and mid-range theory has not been proven. There are no studies which describe the relationship between the levels of stress hormone and behavioral symptoms in daily life among dementia patients.

The authors concentrated on objective evaluations of psychiatric therapy for the elderly with dementia such as animal assisted therapy (AAT) and music therapy, and previously reported the effectiveness of AAT based on evaluations of behavior and stress hormone levels (Kanamori *et al.*, 2001). There are elderly patients who do not like animals, and there are several problems such as breeding and controlling infection in animals in ATT. Compared with ATT, music therapy for patients with dementia is the preferred Japanese medical practice in such places as special wards for dementia and day-care programs.

Stress is defined as a state of threatened homeostasis. The stress response is mediated by the central nervous system, components of the adrenomedullary system and the parasympathetic nervous system (Chrousos, 1998). The activity of the sympathetic and adrenomedullary systems has been evaluated by measuring plasma levels of catecholamines. However, plasma levels of catecholamines are labile, because catecholamines released from the autonomic neurons and adrenal medullary cells are rapidly taken up and metabolized. Salivary chromogranin A (CgA) co-released with catecholamines is a better index of sympathetic activity and CgA levels have been adapted to correlate with the catecholamine release rate (Nakane *et al.*, 1998).

The present study focused on objective evaluations of music therapy for the elderly with dementia and the effectiveness of evaluations of behavior and stress hormone levels. Salivary CgA was used in endocrinological stress evaluation to clarify the changes in stress index in elderly patients who participated in music therapy intervention. This study investigated the evaluation methods of the effectiveness of music therapy for dementia patients using objective cognitive, behavioral functional assessment, and endocrinological stress evaluations. Changes in problematic behavior among the patients were observed to evaluate cognitive and behavioral functional assessments, and to document functional behavior. We used CgA to reflect stress levels in relation to Gerdner's mid-range theory.

METHODS

Patients

Patients comprised 10 persons with senile dementia (4 males and 6 females; mean age 82.00 ± 8.42 years) residing in the dementia special care unit of a geriatric hospital. All patients and their families received a full explanation of the study protocol and written consent was obtained from the families. The music therapy group (MT group) consisted of 10 patients; 6 had dementia of Alzheimer's type (DAT) and 4 had vascular dementia (VD) according to the diagnostic criteria of the American Psychiatric Association (1994). The control group consisted of 13 patients from the same dementia special care unit (4 males and 9 females; mean age 85.23 ± 4.19 years, 6 DAT and 7 VD). The control group did not participate in the music therapy. However, they did participate in an adjacent day room in therapeutic physical activities such as games, drawing and pasting pictures.

Music therapy program

Between 3 October and 28 November 2000, music therapy was provided to all 10 patients, twice a week for 8 weeks, for a total of 16 sessions. These sessions occurred between 10 AM AND 11 AM in the dementia special care unit. Three music therapists and three nurses developed and provided the intervention program, based on the protocol developed by Clair and Bernstein (1990) for patients with dementia. Music therapy included singing songs and playing percussion instruments, such as hand-held drums. The old Japanese songs came from earlier periods of the patients' lives and were based on personal references. Each session was framed by opening with a song that incorporated the names of the patients and ended with a similar song. The goals of music therapy were to stimulate mental and physical function and reinforce social interaction. All 10 patients were encouraged to participate in singing and playing a musical instrument. The

intervention was performed using the same method for a total of 16 times.

Assessment materials

Mini-Mental State Examination

The Mini-Mental State Examination (MMSE), developed by Folstein *et al*. (1975), is the most widely used measure of cognitive function in which the potential score ranges from 0 to 30 points.

N type Mental States Scale and N type Activities of Daily Living

The N type Mental States Scale (NM scale) (0–50 points) and the N type Activities of Daily Living (N-ADL) (0–50 points) were developed in Japan by Kobayashi *et al*. (1988) to evaluate mental status and activities of daily living for elderly patients with dementia. The NM scale and N-ADL are frequently used for clinical observations in Japan.

Multidimensional Observation Scale for Elderly Subjects

The Multidimensional Observation Scale for Elderly Subjects (MOSES) was developed by Helmes *et al*. (1987) to rate behavior in elderly persons. It includes five subscales: self-care, disorientation, depression, irritability and withdrawal. However, only the latter four scales were used in the present study because self-care was evaluated using N-ADL. The subscales of MOSES consisted of 7 or 8 questions, and were rated on a scale of 1–5, where 1 referred to behavior 'not observed' and 5 referred to behavior 'always observed'.

Endocrinological evaluation using salivary chromogranin A

Endocrinological stress was evaluated using salivary CgA, an acid glycoprotein (439 amino acid residues) isolated from chromaffin granules in the adrenal medulla. It coexists and is co-released with catecholamines. Salivary CgA is present in the excretory duct of the submandibular gland and is released into saliva after autonomic nerve stimulation. The CgA concentration has a direct relationship with catecholamine in saliva; therefore, testing for catecholamine provides precise information about CgA levels (Nakane *et al*., 1998). Salivary samples were analyzed using a YK070 chromogranin A EIA kit (Yanaihara Institute, Shizuoka, Japan). To avoid variations due to the circadian rhythm, measurements of salivary CgA were taken at a fixed time, immediately before the initiation of the intervention (10 AM) and immediately after the completion of the intervention (11 AM).

Procedure

The MMSE, NM and N-ADL were administered using standardized procedures by a clinical psychologist and were evaluated at pre-intervention (baseline) and 1 week after completion of the music therapy intervention (2 months). The MOSES evaluations were assessed at pre-intervention (baseline) and 1 week after completion of the music therapy intervention (2 months) by nurses from the dementia special care unit who did not attend music therapy, but who were well acquainted with the daily lives of the patients. The nurse who conducted the pre-intervention assessment for a specific patient also conducted post-intervention assessment. The control group was evaluated using MMSE, NM and N-ADL at the same time as the MT group. Saliva CgA was measured in both groups at 10 AM AND 11 AM as follows: at baseline and pre- and post-intervention for sessions 1, 8 and 16. The collection procedure was explained each time and samples were collected using Salivette (Aktiengesellschaft Company, Walldorf, Germany), and cotton swabs were soaked with the patient's saliva.

Analysis

Differences between pre- and post-intervention scores for the MMSE, NM and N-ADL were compared using the paired *t*-test. Mean differences in CgA before and after each of the 16 sessions were assessed with the paired *t*-test. Changes in CgA for pre-session (10 AM) at baseline, sessions 1, 8 and 16 were analyzed using one-way repeated measures (ANOVA). Data was analyzed using SPSS (ver.10; SPSS Inc., Chicago IL, USA).

RESULTS

Table 1 shows the results obtained using the MMSE, N-ADL and MOSES before and after the completion of 16 sessions of group therapy. The mean of the 'language' subscale of the MMSE showed a significant change from 5.30 (± 2.21) to 6.40 (± 1.35) ($P = 0.012$) in the MT group, but no significant difference in the control group. 'Attention and calculation' scores changed from 0.50 ± 1.27 to 1.30 ± 2.00 in the MT group ($P = 0.07$). The total scores of MMSE changed from 11.60 (± 6.63) to 12.30 (± 5.74) in the MT group, suggesting no significant difference. In addition, the scores of N-ADL changed from 18.20 (± 12.74) to 19.00 (± 11.49) without any significant difference in the MT group. In MOSES, the mean score for irritability, which

Table 1. Changes in scores of the Mini-Mental State Examination (MMSE), N type Mental States Scale (NM), N type Activities of Daily Living (N-ADL) and Multidimensional Observation Scale for Elderly Subjects (MOSES) in the music intervention (MT) and control group

		Baseline		After 2 months		
	Group	Mean	SD	Mean	SD	*P*-value
MMSE						
Orientation (0–10)	MT	2.10	2.42	2.70	2.11	0.140
	Control	2.67	3.11	2.40	3.11	0.389
Registration (0–3)	MT	2.60	1.29	2.10	0.97	0.273
	Control	1.87	1.46	1.93	1.39	0.334
Attention andcalculation (0–5)	MT	0.50	1.27	1.30	2.00	0.070
	Control	0.80	1.42	0.80	1.26	1.000
Recall (0–3)	MT	0.20	0.42	0.20	0.63	1.000
	Control	0.40	0.91	0.73	0.91	0.096
Language (0–9)	MT	5.30	2.21	6.40	1.35	0.012
	Control	4.13	2.87	4.60	2.44	0.388
Visualconstruction (0–1)	MT	0.20	0.42	0.30	0.48	0.343
	Control	0.20	0.41	0.21	0.43	1.000
Total score (0–50)	MT	11.60	6.63	12.30	5.74	0.285
	Control	9.15	7.09	10.31	6.79	0.260
NM scale						
Housework (0–10)	MT	1.10	2.08	1.00	2.11	0.343
	Control	0.54	1.13	0.69	0.85	0.549
Interest, motivation andcommunity (0–10)	MT	3.20	2.39	3.60	2.50	0.168
	Control	2.69	1.11	2.77	1.83	0.837
Conversation (0–10)	MT	3.80	2.35	4.00	2.71	0.343
	Control	3.92	2.25	3.77	2.65	0.673
Cognition and memory(0–10)	MT	3.30	2.41	3.40	2.27	0.343
	Control	2.85	2.10	2.85	2.10	—
Orientation (0–10)	MT	3.40	1.84	3.40	1.83	—
	Control	3.38	2.69	3.54	2.73	1.000
Total score (0–50)	MT	14.80	10.51	15.40	10.01	0.113
	Control	13.38	9.79	13.54	8.24	0.357
N-ADL						
Walking and transfer(0–10)	MT	4.20	4.13	4.20	4.13	—
	Control	3.00	2.45	2.85	2.64	0.673
Living sphere (0–10)	MT	4.00	1.05	4.00	1.05	—
	Control	4.08	1.04	3.62	1.26	0.082
Dressing and bathing(0–10)	MT	2.50	2.84	2.60	2.59	0.758
	Control	1.85	2.48	1.77	1.64	0.874
Eating (0–10)	MT	5.00	1.33	5.20	1.99	0.591
	Control	4.62	2.14	4.77	2.39	0.753
Toileting (0–10)	MT	2.50	2.99	3.00	4.03	0.363
	Control	2.85	3.53	2.31	2.95	0.151
lN-ADL (0–50)	MT	18.20	12.74	19.00	11.49	0.223
	Control	16.38	8.58	15.31	9.87	0.286
MOSES						
Disorientation (7–33)	MT	18.20	6.29	20.20	7.47	0.138
	Control	20.08	6.97	20.31	8.28	0.806
Depression (8–37)	MT	12.62	5.94	14.38	6.67	0.545
	Control	9.00	2.11	8.60	1.26	0.368
Irritability (8–32)	MT	12.00	3.06	9.90	3.14	0.000
	Control	13.69	4.80	12.92	5.25	0.605
Withdrawal (8–34)	MT	21.10	7.26	22.80	8.53	0.279
	Control	24.62	5.33	26.08	4.25	0.188

indicated the degree of burden on caregivers and aggressiveness of patients, significantly decreased from 12.00 (± 3.06) to 9.90 (± 3.14) ($P = 0.0001$) in the MT group. No significant changes were observed in the control group ($P = 0.490$).

Figure 1 shows changes in salivary CgA levels before intervention for sessions 1, 8 and 16. The MT and control patients were asked to participate in the saliva collection, however, several were not able to tolerate the procedure and others occasionally refused to allow cotton swabs to be inserted into the mouth. Some patients did not secrete enough saliva to measure CgA. In the MT group, results were obtained from six patients from whom saliva was collected at 10 AM AND 11 AM each day for a total of four times: baseline, sessions 1, 8 and 16. Mean values before music therapy intervention at 10 AM AND 11 AM slightly increased from 1.433 (± 0.539) to 1.484 (± 0.643) pmol/mL. The mean value in the first session slightly decreased from 0.9101 (± 0.556) to 0.541 (± 0.227) pmol/mL ($P = 0.806$). In session 8 there was a decrease from 1.476 (± 0.721) to 0.987 (± 0.433) pmol/mL ($P = 0.053$). There was also a significant decrease from 1.683 (± 0.596) to 1.257 (± 0.581) pmol/mL in session 16 ($P = 0.048$).

Figure 2 shows salivary CgA levels in the control group at baseline, first week, fourth week (session 8) and the eighth week (session 16). In the control group, results were obtained from seven patients from whom

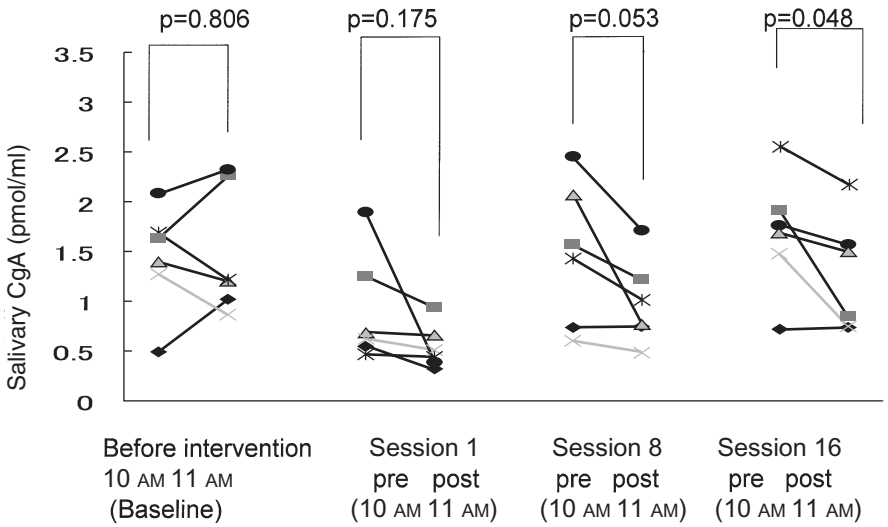

Figure 1. Comparison between pre- and post-intervention salivary chromogranin A (CgA) in the music intervention group.

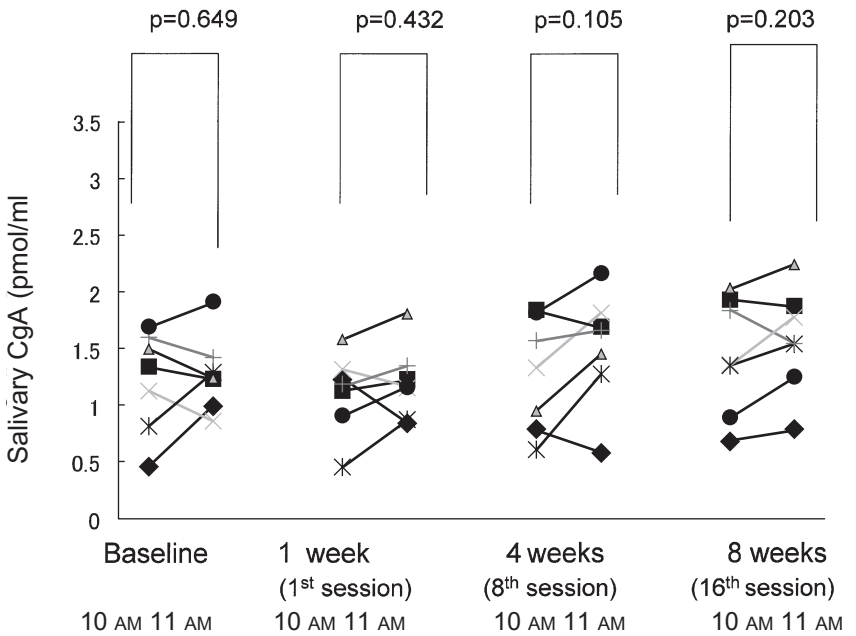

Figure 2. Comparison between levels of chromogranin A (CgA) in the control group at 10 AM and 11 AM.

saliva was collected at 10 AM (pre-session) and 11 AM (post-session) each day for a total of four times: baseline, sessions 1, 8 and 16. In the control group, only seven patients provided saliva samples because of similar reasons given in the MT group. Mean values before intervention slightly increased from 1.218 (± 0.450) to 1.280 (± 0.336) pmol/mL, and in the eighth week also slightly increased from 1.440 (± 0.523) to 1.572 (± 0.463) pmol/mL. Using one-way repeated measures, additional comparisons for pre-session (10 AM) CgA at baseline, weeks 1, 4 and 8 showed no significant differences for the MT group ($P = 0.224$) or the control group ($P = 0.116$), and there were no differences among the four sessions in either group.

CASE REPORT

Case A

This patient was an 86-year-old male. Vascular dementia pre-session and post-session according to the MMSE were both 11, 20 to 16 on the NM scale, respectively, and 31 to 28, respectively, on the N-ADL. On the MOSES, pre-session and post-session disorientation was 18 to 23; depression 13 to 8; irritability 12 to 8 and; withdrawal 20 to 20, respectively. This patient had most improvements in MOSES. Levels of CgA before intervention (10 AM) were 1.639 pmol/mL and rose to 2.265 pmol/mL after intervention (11 AM). At the first session levels were 1.243 pmol/mL before and 0.938 pmol/mL after, at the eighth session they were 1.564 pmol/mL before and 1.210 pmol/mL after, and at the 16th session levels were 1.903 pmol/mL before and 0.837 pmol/mL after.

The patient's activities of daily living included independence in walking and movement and bladder and bowel incontinence. He had confusion and agitation and demonstrated behaviors such as hitting or scratching the nursing staff. He did not take initiative or speak voluntarily before the music therapy intervention. During the first session he was emotionally affected and cried because of the nostalgic songs. He voluntarily participated in the music activity every time and spoke to nurses in a positive manner. He asked, 'What will we sing next?' This patient had no agitated behavior during the sessions. Moreover, his agitated behavior at night-time decreased, and the hitting and scratching while the nurses were changing his diaper decreased, especially after the 12th music therapy session.

Case B

This patient was a 90-year-old female. Vascular dementia pre-session and post-session according to the MMSE were both 13, and both 5 on the N-ADL, while on the NM scale scores were 6 and 8, respectively. On the MOSES scores pre- and post-session for disorientation were 20 and 23; 8 and 8 for depression; 12 and 8 for irritability and; 30 and 30 for withdrawal, respectively. Levels of CgA before the intervention were 2.090 pmol/mL and 2.328 pmol/mL after intervention. In the first session, CgA levels were 1.895 pmol/mL presession and 0.379 pmol/mL post-session, 2.447 pmol/mL pre- and 1.710 pmol/mL post-session in the eighth session and; at the 16th session levels were 1.764 pmol/mL before the intervention and 1.564 pmol/mL afterwards.

Patient B had right-sided paralysis and she used a wheelchair in the daytime. Her posture was unstable because her lower limbs had contractures. She always leaned and had a tendency to fall out of her wheelchair. The patient did not speak voluntarily before music intervention started, however, by the fifth session she smiled and greeted the nurses. Her posture became steady and she paid attention to the music therapist and nurses during the sessions. The nurses asked her about music therapy after every session. At the seventh session, she stated; 'I enjoyed singing very much and I was happy.' During the 11th session she laughed aloud when she noticed that a mistake was made in the lyrics while singing. Her expressiveness increased and she actively participated. Afterwards, she gazed attentively at the nurses and smiled. She also talked with other patients during the sessions.

DISCUSSION

The present study used long-term evaluation measures such as the MMSE and MOSES to assess changes that occurred pre- and post-intervention. For the MT group, 'irritability', as assessed long-term by MOSES, was significantly decreased compared to the control group which showed no change. Gerdner (1997) and Clark *et al*. (1998) reported a reduction in agitation among dementia patients during music therapy. Moreover, the results showed that irritability decreased among the elderly patients in their daily life after 16 sessions of music therapy. In comparison to the control group, total scores on the MMSE did not reflect long-term improvements. However, the MT group scores on the MMSE 'language' subscale did demonstrate a significant improvement. An increased language score suggests that singing and listening to music stimulates and reinforces language abilities.

Salivary CgA is used as a parameter of autonomic adrenal system activity and CgA was measured according to methods reported by Nakane *et al*. (1998). Miluk-Koasa *et al*. (1994) reported that patients who

had listened to music prior to surgery had decreased levels of salivary cortisol.

In the present study, saliva was collected at baseline and immediately before and after the first, eighth and 16th sessions. Changes in salivary CgA concentration were investigated during the 16 interventions. Levels before and after each of the 16 intervention sessions were found to be inconsistent. The mean values from baseline to 8 weeks in both groups were slightly increased both pre- (10 AM) and post-intervention (11 AM), but there were no significant differences in the change of the four pre-session (10 AM) CgA values. However, there was a slight increase in levels at 10 AM and 11 AM prior to starting the intervention. The means in the first and eighth sessions were slightly decreased, and in the 16th session was significantly decreased before and after each session. Previously, we reported salivary CgA was relatively reduced during AAT for the elderly with senile dementia (Kanamori *et al*., 2001) and salivary CgA was also decreased by music therapy. These results concurred with our previous study on ATT. There were slight differences in mean values before music therapy in three sessions, the highest mean value was seen during the 16th session and this difference before and after the 16th session was markedly decreased. This suggests that music therapy had relaxing effects on the comparatively high stress levels among elderly patients in this study.

According to Hall and Buckwalter's (1987) conceptual model for care of adults with Alzheimer's disease, cognitive impairment results in the progressive decline of the stress threshold. Agitation occurs when increased levels of stress related to events such as frustration, anxiety and fatigue exacerbate agitation and lead to detrimental behavior. Irritable behavior, as measured on the subscale of MOSES, also indicated that aggressiveness of patients was significantly decreased. These results suggest that decreased salivary CgA was related to the emotional stimulus of the music intervention. In this study, the use of planned music therapy decreased stress and resulted in changes in CgA and decreases in irritable behavior.

Gerdner (1997, 1999) recommended that music therapy be integrated into the patient's life and be based on personal references. Individual and internal feelings expressed by music are useful for personalized music therapy in Western society. However, in Japanese society, individuals are expected to adjust to the group. Therefore, in the clinical setting elderly persons express individual feelings through the melody and harmony of the common nostalgic songs used in group therapy. Cognitive, physical and psychological stimulation occurs during the group dynamics of sharing mutual experiences. Case A and B had improvements in MOSES. For patient A, the care burden was reduced after 16 sessions of music intervention. Patient B had improvements in posture and smiled more frequently. Moreover, their CgA levels decreased after each session. Our results support Gerdner's mid-range theory that long-term music therapy has positive effects during the music intervention and in the daily life of elderly patients with dementia.

In conclusion, the endocrinological measurement of CgA levels appears to be a useful supplementary evaluation for investigating changes in stress levels of the elderly with dementia over short-term periods, such as at pre- and post-intervention, and the changes in CgA levels supported Gerdner's mid-range theory. As for problematic behavior, prior to MT, CgA levels before the first session were high compared with those before the 16th session. Stress levels continued to fall for 8 weeks during the MT intervention. In addition, after only a week of MT, stress levels were significantly lower, as evidenced by lower CgA levels. We found that levels of CgA were decreased after each session, and concluded that these levels were a useful supplementary evaluation for stress levels in music therapy. The combination of the endocrinological measurement of CgA, behavioral evaluation and functional assessment methods, including the MMSE and MOSES, were useful in evaluating the effects of music therapy in persons with senile dementia. Our focus was to evaluate the effects of music therapy in dementia patients through cognitive and behavioral assessment and endocrinological stress evaluation. The present study consisted of 10 patients with DAT and VD. Although it is critical to differentiate the diagnosis between DAT and VD, the treatment and care program are essentially the same for both diagnostic categories in the dementia care unit in Japan. Two cases were reported in the present study of patients with VD who showed improvement. Thoughts and behavior of patients with DAT during the music therapy intervention were better than that of typical daily patterns. Marked improvements were not seen among patients with DAT, however, the number of patients was limited. Additional research will be needed before the differences in the effect of music therapy for VD and DAT patients are conclusive. We attempted to clarify Gerdner's thesis using endocrinological stress evaluation and patients with two types of severe dementia. Even though the number of patients was limited, it was clear that stress levels after music therapy intervention were decreased. However, additional research using music therapy is needed in a variety of clinical settings with larger samples. Future studies should be conducted to clarify the relationships between music therapy, stress levels, measurement of stress hormones, and modifica-

tion of behavioral problems among elderly patients with dementia. These types of studies are necessary to delineate theory related to conceptual models such as Hall and Buckwalter's (1987) care of adults with Alzheimer's disease.

Music therapy is intended to promote changes in physiological, behavioral and emotional responses and may be potentially useful for any patient who is experiencing health problems related to stress or disorders of the circulatory system. Gwendolyn (1997) points out that music therapy may facilitate a reduction in the stress response such as decreases in anxiety levels, blood pressure and heart rate, along with changes in plasma stress hormone levels. Additional studies with patients from all age groups should be conducted to evaluate music therapy and its effects on the endocrine and autonomic nervous systems. Clinically based studies should evaluate the effects of various types of music programs in a wide range of clinical settings, such as acute and chronic units in hospitals, community health centers, outpatient clinics, and institutions for the disabled. Both clinical and designed laboratory studies using music therapy with healthy normal adults and patients with stress-related disorders will provide scientific rationale for evidence-based clinical practice.

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