

## Research Article

# Possibility of Subjective Quality of Life Improvement during Individual Music Intervention in Elderly People with Severe Dementia: The Pilot Study

**Mayumi Sakamoto<sup>1\*</sup>, Noriko Nagao<sup>1</sup> and Saki Shiraishi<sup>2</sup>**

<sup>1</sup>Kobe University Graduate School of Health Sciences, Japan

<sup>2</sup>Department of Nursing, Kobe University Hospital, Japan

\*Corresponding author: Mayumi Sakamoto, Kobe University Graduate School of Health Sciences, 7-10-2 Tomogaoka Suma-ku Kobe-city, Japan, Tel: +81-78-796-4599; Email: sakamoto@sonoda-u.ac.jp

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## Abstract

Quality of Life (QOL) is a worldwide issue resulting from a sudden increase in dementia and is intensified by increasing severity consequent to decreasing cognitive function. Music therapy could potentially stimulate cognitive function people with dementia. However, relatively few studies have investigated QOL during music intervention. Therefore, we investigated the effects during an interactive music intervention on subjective QOL, as well as evaluation methods in elderly people with severe dementia. We performed behavioral analyses during group leisure activities in the weeks before and after interactive music intervention (once weekly for 5 weeks) using "music with a special personal meaning". The participants were 3 elderly people with severe dementia. We measured emotional states and spontaneity to represent subjective QOL measurement, and combined a single-subject reversal design (A-B-A) with a multiple baseline design among the participants. Compared with the ratio during the participants' leisure activities, their average "sustained attention" activity ratio during music intervention dramatically increased. Moreover, the average ratio of post-intervention during leisure activities was higher than one of pre-intervention. Furthermore, the average "fun", "satisfaction", and "spontaneous speech" activity ratios during music intervention also increased, comparing with leisure activities. Interactive intervention involving music with a special personal meaning activates attentional functions and awakens positive emotions in elderly people with severe dementia, suggesting a subjective QOL improvement. The behavioral analysis evaluation method used herein requires an analytical precision and limitation of dependent variables; however, it is an effective way to understand people with severe dementia and communication issues.

**Keywords:** Subjective QOL; Behavioral analysis; Dementia; Elderly; Music intervention

## Abbreviations

ARS: Philadelphia Geriatric Center Affect Rating Scale; BPSD: Behavioral and Psychological Symptoms of Dementia; HDS-R: Hasegawa's Dementia Rating scale; PWD: People with Dementia; QOL: Quality of Life

## Introduction

The number of people living with dementia worldwide in 2013 is estimated at 44.35 million, reaching 75.62 million in 2030 and 135.46 million in 2050 [1]. In Japan, an estimated 7 million people (1 in 5) will have dementia by 2025. In response, the Japanese government has promoted measures targeting dementia that focus on the quality of life (QOL) and form a foundation for a "society that respects the preferences of people with dementia and that allows a person to live being oneself in a comfortable and familiar environment [2]. Dementia is a progressive neurodegenerative disease that affects the abilities of memory, thought, movement, and daily activity performance [3,4]. An effective treatment for dementia has yet to be established and, depending on the reduction in cognitive functions and environmental factors, a variety of behavioral and

psychological symptoms of dementia (BPSD) may appear [5]. For example, impaired cognition or perception can lead to reduced goal-directed behavior (a loss of or diminished interest observed in leisure activities), loss of self-initiated behavior, and loss of environment-stimulated behavior due to apathy and stemming from a lack of connection with people or the environment and a subsequent loss of or diminished motivation [6]. Furthermore, behavioral disorders such as aggression may occur, because of uncertainty and fear. These disorders exacerbate the QOL of People with Dementia, (PWD) and their families [7,8]. Currently, a combination of non-pharmacological and appropriate pharmacological measures is being used to treat BPSD. However, there is no evidence to support a consistent, specific strategy for treating the variety of dementia-related symptoms and the promotion of safer, non-pharmacological interventions over pharmacological treatment methods is expected [5]. In particular, music intervention is a non-pharmacological treatment method with a high likelihood of decreasing BPSD [9-12] and is therefore expected to contribute to the QOL improvement of PWD. On the other hand, O'Rourke et al. described the following factors as affecting the QOL according to the PWD's point of view: (1) relationships: together vs. alone, (2) agency in life today: purposeful vs. aimless, (3)

wellness perspective: well vs. ill, and (4) sense of place: located vs. unsettled. These 4 factors and the experience of connectedness can improve the QOL of PWD. In addition, the authors reported that in PWD, happiness is the experience of feeling pleasure, contentment, satisfaction, or joy [13]. Music intervention, which induces positive emotions, is quite likely to facilitate improvements in these QOL factors, and several studies have already reported the effects of musical therapy on QOL improvements in PWD [14,15]. However, relatively few studies have evaluated QOL during music intervention. To support effective musical therapy in people with severe dementia, it is important to investigate the experiences of music intervention and effect on QOL during intervention in addition to verifying the benefits of stimulation through comparative before-and-after studies, as it is difficult to connect the 4 factors described by O'Rourke in elderly people with severe dementia and severely reduced cognitive function. Therefore, the time during musical intervention is an important time and place in which people with severe dementia can make such connections in daily life. Furthermore, Lowton, who proposed the QOL concept in PWD, argues that an evaluation of QOL should include both subjective and objective elements [8,16]. However, as the severity of dementia increases, there is an increasing reliance on objective evaluation as it becomes difficult to evaluate

the subjective QOL in PWD. Therefore, we evaluated a subjective QOL measured through the expressions and actions of PWD based on Lowton's Philadelphia Geriatric Center Affect Rating Scale (ARS) [8], and not on caregiver-based information. We verified the effects during musical intervention and performed a behavioral analysis of emotional states and spontaneity, which are parts of the subjective QOL, in elderly people with severe dementia. Thus this pilot study investigated the effects of musical intervention and the evaluation methods in elderly people with severe dementia.

## Materials and Methods

### Participants

Three participants who lived in a geriatric health services facility and fulfilled the following criteria were included in the study: aged  $\geq 65$  years, Alzheimer-type dementia diagnosis, moderate to severe dementia with a score of  $\leq 10.7$  on Hasegawa's dementia rating scale (HDS-R) [17], no hearing impairment, and no professional experience playing an instrument.

### Music stimulation

We used "music with a special, personal meaning" for the music stimulation. We selected music that would awaken positive emotions

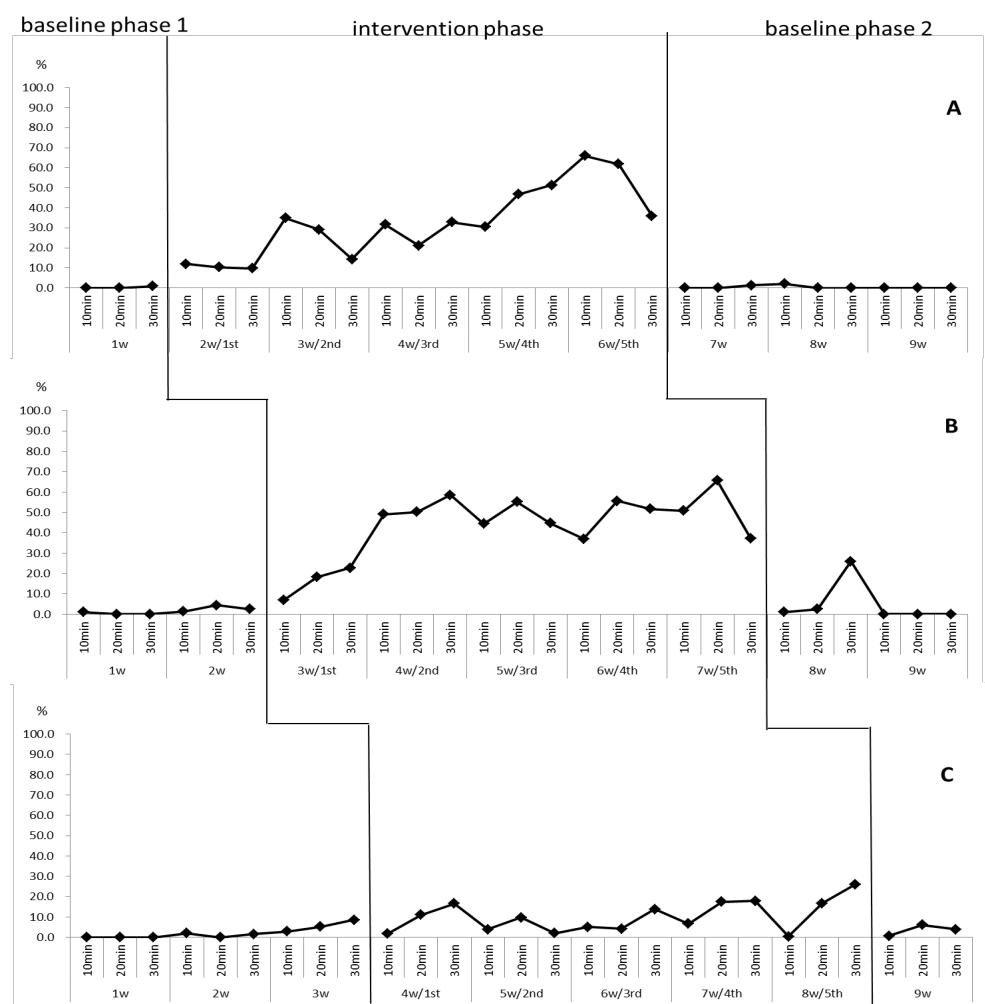
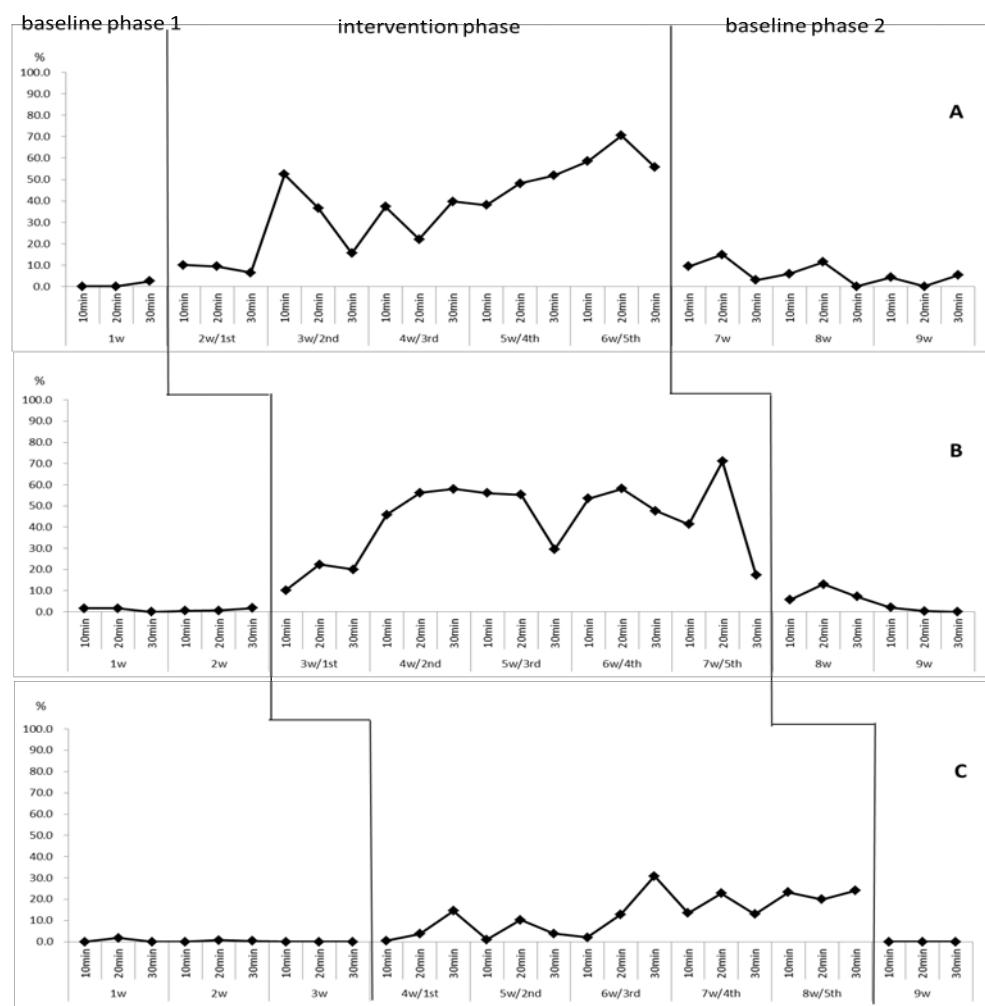


Figure 1: Changes to the "pleasure" activity ratio.



**Figure 2:** Changes to the "contentment" activity ratio.

such as happiness and joy according to the participants' generational backgrounds, as determined through an investigation of their life histories and detailed interviews of the participants or their families [12].

## Procedure

The baseline was set at leisure activity during the weeks before and after the music intervention, and we selected an interactive music intervention with "a special, personal meaning" to the participants. The activity time intervals during leisure activities and the music intervention were 30 minutes; music interventions occurred once weekly for 5 weeks (for a total of 5 interventions) and occurred between, 10:30 am and 11:30 am on the same day of the week. Measurements of behavioral observations were obtained in a common room during leisure time (baseline) and in an individual room during music interventions. Furthermore, we provided pamphlets containing lyrics or photographs of the artist or movie during the music interventions. We used a Pioneer X-SMC2-W audio system (Pioneer Corporation, Kawasaki, Japan). The volume was adjusted to the participants' preferences. To prevent failed experiences, the music intervention setting was adjusted to each participant's degree of cognitive function so that they could enjoy the music freely. Leisure time activities

occurred through active staff interventions with a group of nursing home residents who were gathered in the common room.

## Study design

To investigate the effect during music intervention on the QOL of PWD, we combined a single-subject reversal design (A-B-A) with a multiple baseline design among the participants.

## Data collection

We recorded 30 minutes of video footage to capture changes during leisure time activities for 1–3 weeks before the music intervention (baseline phase 1), during the music intervention (intervention phase), and 1–3 weeks after music intervention (baseline phase 2). Subjective QOL performance measurements were the emotional state and spontaneity (spontaneous speech and sustained attention), based on the ARS criteria. We analyzed the times of these activities every 10 minutes in each phase.

## Dependent Variables

### Philadelphia geriatric center affect rating scale (ARS)

We adapted this scale as a subjective QOL because it evaluates the 6 emotions of pleasure, contentment, interest, anger, anxiety/

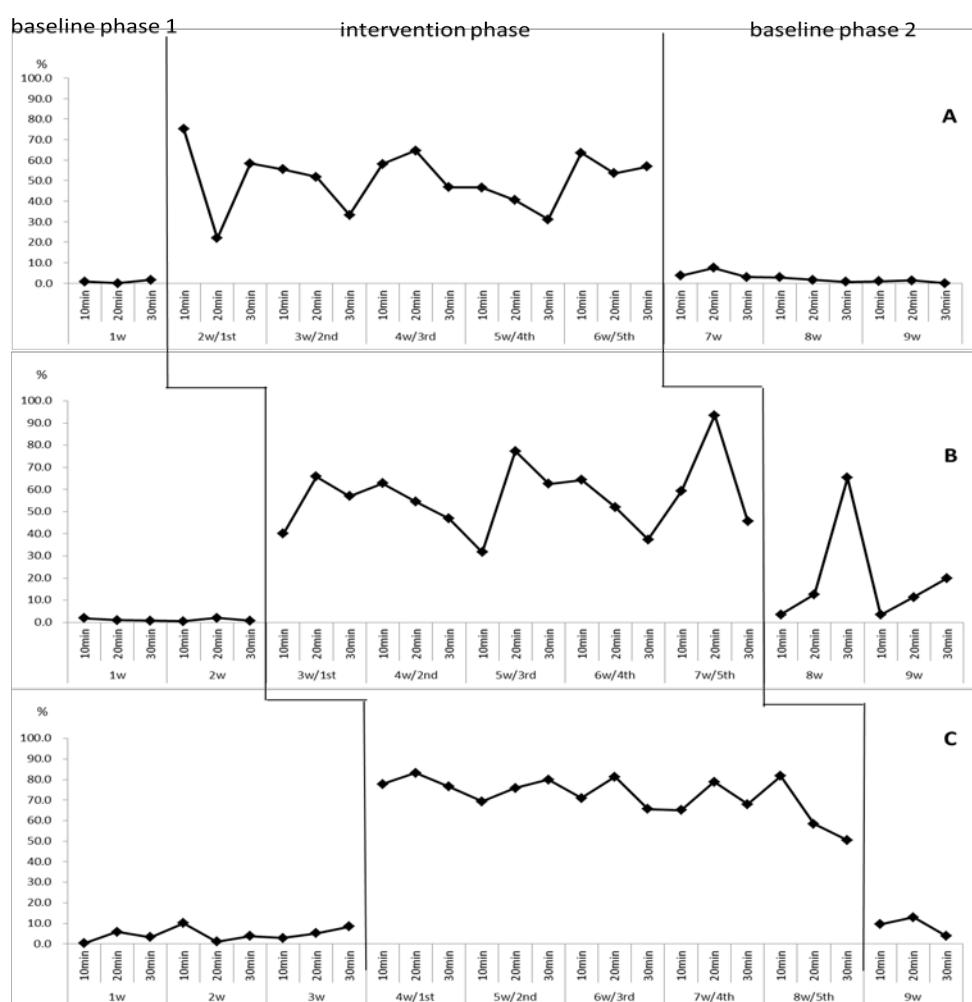


Figure 3: Changes to the “interest” activity ratio.

fear, and depression/sadness through emotions and behavior and has been suggested as reliable among test subjects [8]. The author video-recorded the emotions and behaviors of PWD during the baseline and intervention phases and measured the reaction times using this scale. The 6 emotions were defined as follows: “pleasure” was defined as smiling, laughing, stroking, touching lovingly, nodding, singing, and clapping in rhythm; “contentment” was defined as sitting in a relaxed posture, relaxed expression, calm movements, and confident expressions or behavior; “interest” was defined as following people or things with the eyes, staring at people or things, reactions with expressions, movements, and language, eye contact, bodily or verbal reaction to music, and facing or moving towards people and things; “anger” was defined as clenching jaws, frowning, cursing, scolding, shoving, shaking fists, pouting, and glaring; “anxiety/fear” was defined as knitting of the brows, restlessness, repetitive movements (as if irritated), fear and sighing, isolation from others, shaking, nervous expression, frequent shouting, clasping of hands, shaking legs (irritated), and pacing; and “depression/sadness” was defined as loud crying, tearing, heaving sighs, and a drooping head.

#### Spontaneous reaction times

The durations of spontaneous speech and sustained attention

were used as indicators of spontaneity. Spontaneous speech was defined as utterances by participants directed at another without encouragement from staff or the music provider. We excluded utterances immediately after influences from staff or the music provider. Sustained attention is the ability to actively manage incoming information for a set duration. In this study, we defined this ability as a focused participation in leisure time activities or music intervention while the participant was awake.

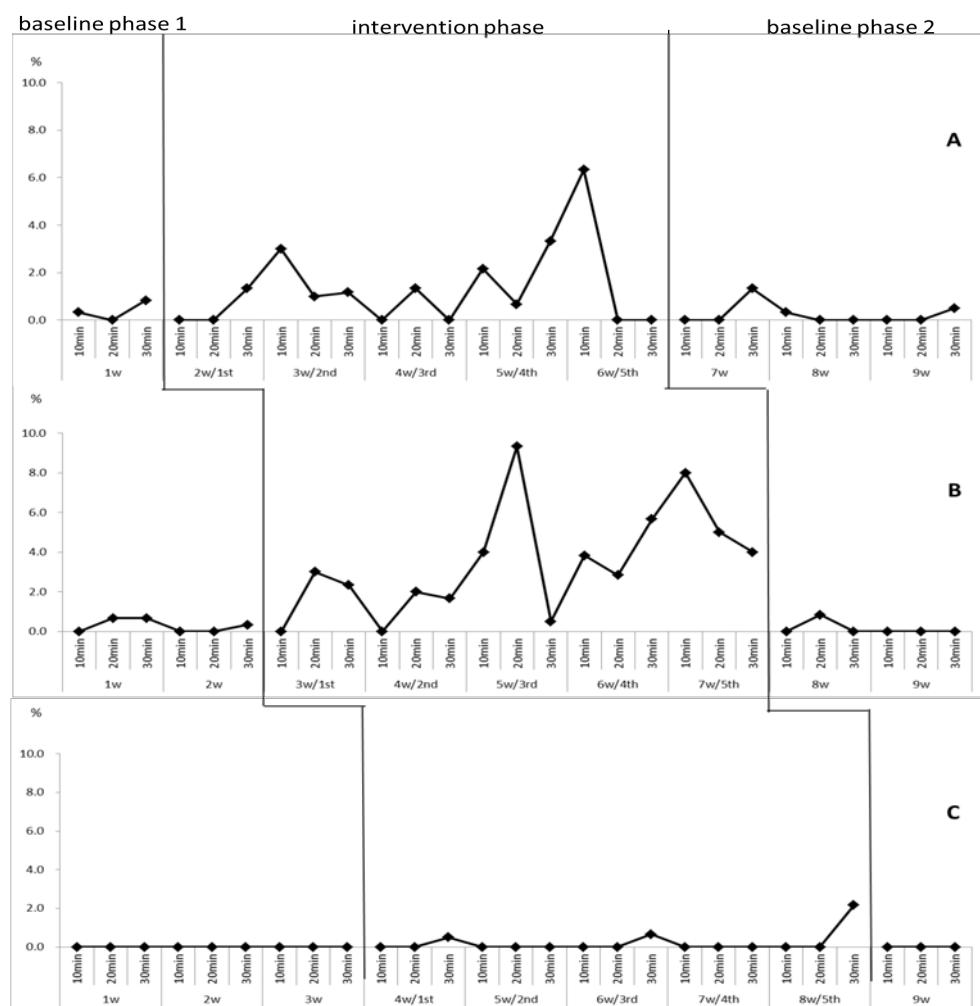
#### Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki and approved by and registered by the ethical committee of Kobe University Graduate School of Health Sciences.

## Results

#### Participant characteristics

The participants were 3 males living in a geriatric health services facility with Alzheimer-type dementia (A: 80s in age, HDS-R: 6 points; B: 90s in age, HDS-R: 9 points; C: 60s in age, HDS-R: 0 points). The participants’ communication abilities were as follows: A, relatively preserved situational awareness with reaction when spoken to, but difficulty with conversation; he was not well acquainted with anyone.



**Figure 4:** Changes to the “spontaneous speech” activity ratio.

B, not fluent but could carry a simple, coherent conversation with assistance; he was not well acquainted with anyone. C, understood simple questions but hardly spoke; he was not well acquainted with anyone.

#### Effect of music intervention on emotional states (effect on the subjective QOL)

We calculated the activity ratios from expressions and behaviors during baseline phase 1, the intervention phase, and baseline phase 2 in accordance with the ARS criteria to determine the effect on the subjective QOL during music intervention on the participants’ emotional states. The activity ratio (%) was defined as the percent of total leisure time or total music intervention time (30 minutes) spent in the expression and/or behavior.

#### Changes to the “pleasure” activity ratio (Figure 1)

Regarding the average activity ratio results, the following average expression/behavior durations were observed during each phase. During baseline phase 1, the ratio was 1.7%:10 s (A = 0.3%:1.7 s, B = 1.5%:9.7 s, C = 2.2%:13.3 s). During the intervention phase, the ratio was 28.6%:171.8 s (A = 32.6%:195.4 s, B = 43.2%:258.9 s, C = 10.2%:60.1 s). During baseline phase 2, the ratio was 2.4%:14.4 s (A

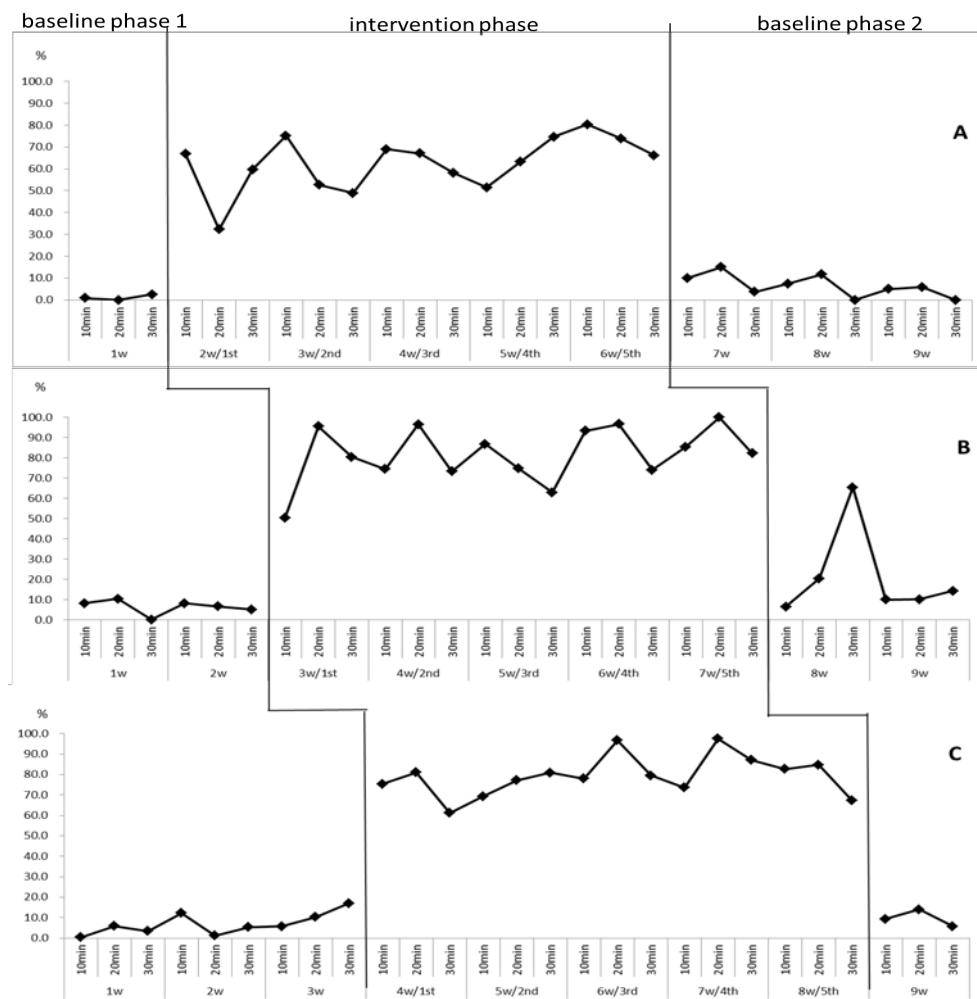
= 0.4%:2.2 s, B = 4.9%:29.3 s, C = 3.5%:21 s). Compared with the baseline phases, the “pleasure” activity ratio increased dramatically during the intervention phase.

#### Changes to the “contentment” activity ratio (Figure 2)

Regarding the average activity ratio results, the following average expression/behavior durations were observed during each phase. During baseline phase 1, the ratio was 0.7%:3.9 s (A = 0.8%:5.0 s, B = 1.1%:6.3 s, C = 0.3%:2.0 s). During the intervention phase, the ratio was 30.9%:185.4 s (A = 36.8%:220.8 s, B = 42.8%:256.9 s, C = 13.1%:78.5 s). During baseline phase 2, the ratio was 4.6%:27.5 s (A = 6%:36.2 s, B = 4.7%:28.2 s, C = 0%:0 s). Compared with the baseline phases, the “contentment” activity ratio increased dramatically during the intervention phase.

#### Changes to the “interest” activity ratio (Figure 3)

Regarding the average activity ratio results, the following average expression/behavior durations were observed during each phase. During baseline phase 1, the ratio was 2.8%:16.8s (A = 0.8%:5.0 s, B = 1.1%:6.7 s, C = 4.6%:27.4 s). During the intervention phase, the ratio was 59.8%:359 s (A = 50.6%:303.3 s, B = 56.7%:340.3 s, C = 72.2%:433.3 s). During baseline phase 2, the ratio was 9.1%:54.7 s (A = 2.4%:14.4



**Figure 5:** Changes to the “sustained attention” activity ratio.

s, B = 19.4%:116.2 s, C = 8.8%:52.7 s). Compared with the baseline phases, the “contentment” activity ratio increased dramatically during the intervention phase. Additionally, we observed an increase in baseline phase 2 relative to phase 1.

#### Changes to the “anger”, “anxiety/fear”, and “depression/sadness” activity ratios

No differences were observed between the baseline phases and the intervention phase in any participant in terms of the expression/behavioral durations of “anger”, “anxiety/fear”, and “depression/sadness”.

#### Effect of music intervention on spontaneity

We calculated the activity ratios from the reaction duration of spontaneous speech and sustained attention in a manner similar to that described for the emotional states.

#### Changes to the “spontaneous speech” activity ratio (Figure 4)

We defined and measured “spontaneous speech” as speech initiated by the participant and not in reaction to another individual. As a result, the average activity ratio: the average duration of spontaneous speech for all participants during baseline phase 1 was

0.2%:0.94 s (A = 0.4%:2.3 s, B = 0.3%:1.7 s, C = 0%:0 s). The average during the intervention phase was 1.7%:10.1 s (A = 1.4%:8.1 s, B = 3.5%:20.9 s, C = 0.2%:1.3 s). The average in baseline phase 2 was 0.2%:1.0 s (A = 0.2%:1.4 s, B = 0.1%:0.8 s, C = 0%:0 s). Compared with the baseline phases, the activity ratio increased during the intervention phase.

#### Changes to the “sustained attention” activity ratio (Figure 5)

The average activity ratio: the average duration of sustained attention for all participants during baseline phase 1 was 5.7%: 34.1 s (A = 1.1%:6.7 s, B = 6.3%:37.8 s, C = 6.8%:40.8 s). The average during the intervention phase was 74.6%:447.6 s (A = 62.6%:375.7 s, B = 81.7%:490.4 s, C = 79.4%:476.6 s). The average in baseline phase 2 was 11.9%:71.2 s (A = 6.5%:39.1 s, B = 21%:126 s, C = 9.7%:58 s). Compared with the baseline phases, the activity ratio increased dramatically during the intervention phase. Additionally, we observed an increase in baseline phase 2 relative to phase 1.

#### Discussion

Our results demonstrate the possibility that positive emotions, spontaneity, and attentional function which comprise a portion of

the subjective QOL, can be elicited from elderly people with severe dementia during interactive music interventions. It suggests the subjective QOL improvement by stimulating with individual music intervention. Interestingly, when compared with staff-influenced group leisure time activities, individualized interactive music interventions that used "music with special meaning" dramatically increased the average "interest" and "sustained attention" activity ratios. Although focal attention towards things of temporary interest is relatively preserved in PWD, the sustained attention required to maintain continuous focus is impaired [18,19]. Therefore, they can't improve the subjective QOL, such as arousal of positive emotions and improvement of spontaneity. However, during music intervention, the participants maintained focus for substantially longer intervals and moved more spontaneously, compared with leisure time activities. These activities manifested in participants as moving their bodies to the music and looking at pamphlets for a long time. Participants A and C were less reactive or exhibited only temporary reactions to staff notifications and activities prior to the music intervention. Participant B hardly paid attention to activities during leisure time. These findings suggest that interactive music intervention activated both focal and sustained attention. Additionally, both "interest" and "sustained attention" increased during leisure time activities after stimulation when compared to those before music intervention. This suggests the sustained activation of attentional function after musical stimulation. QOL improvement, interactive music intervention served as an attractive attention stimulus, even in participants with severe dementia, indicating the strong possibility that this intervention method is suitable for such participants' subjective QOL improvement. Moreover, given that the "fun", "satisfaction", and "spontaneous speech" activity ratios increased during music intervention, appropriate musical stimulation could invoke positive emotions and spontaneous activity, even in people with severe dementia. Finding relationships with others, being situationally aware, and performing activities with purpose are more difficult for people with dementia as the severity of this condition increases; however, these types of interventions comprise a care method that they can pave the way toward reconnection independently. In other words, it is possible that music intervention will lend support to care intended to improve the subjective QOL of PWD, as stated by O'Rourke et al. Next, we will discuss the evaluation methods using a behavioral analysis. Evaluation methods that measure subjective information from objective information such as the expressions and behaviors of PWD become important indices when studying subjects who have difficulty speaking. The quantification of quality data to determine participants' emotions and spontaneity is a simple method with which to improve the quality of music interventions or care. However, a behavioral analysis of the influence of interventions to determine the factors affecting the quality of intervention and QOL improvements will be necessary in future studies. Moreover, in the present study the video data analysis was performed by a single trained nurse; therefore, it will be necessary for multiple nurses to perform such analyses in order to increase the accuracy and investigate reliability.

## Conclusion

In conclusion, we have demonstrated the possibility that even in short-duration interventions (e.g., 5 times), an individualized,

interactive musical intervention involving music with special meaning for the individual can affect the attentional function and emotional state, as well as improve the subjective QOL in elderly people with severe dementia. Although this behavioral analysis-based evaluation method will require further investigations of participants and data analysis methods, this is an effective first step towards an understanding of people with severe dementia for whom communication is challenging.

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