Assistive Technologies for People with Dementia: Personal Review

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Chapter 7 Music Therapy and ICT

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7.1 Review of Music Therapy

Music and Dementia: Music is a powerful medium. Its effects can calm us, excite and persuade us, inspire us, and lift our spirits especially when we are cognitively impaired or facing end of life. It may even be that in Alzheimer's disease and related dementias, musical memory is spared. Music has the capacity to be a means of connecting, communicating, companioning, and preserving the self along the long, dark journey (Foster, 2009). The use of music therapy allows a unique method of communication for individuals who have difficulties with language. The musical abilities of individuals with dementia remain intact for an extended period of time, despite cognitive deterioration（Ingram, 2012).

Music therapy is one of the methods known to alleviate BPSD. For this reason, caregivers will play music on an audio system on a daily basis. A music therapist may also come once in a while to the nursing home and perform music therapy. The music therapy has no particular form or content. In institutions, the patients often spend one- or two-hours singing songs, playing musical instruments, doing body exercises to the music, and so on, led by the music therapist. It is a pleasure for them to play musical instruments by themselves. In some cases, they talk about the past and talk about their past lives to the others after their music sessions (Oshima, Nakayama, Yasuda et al., 2010).

Definiton of Music Thrapy (MT): MT is one example of a non- pharmacological treatment that has been used to treat individuals with dementia. The World Federation of Music Therapy (2011) describes MT as the use of music and/or its musical elements by a qualified music therapist, on an individual or group basis, through a formally defined process. This process is designed to facilitate and promote communication, relationships, learning, mobilization, expression, organization and other relevant therapeutic goals. Two types of MT were distinguish: The first is referred to as ***receptive MT***, in which the music therapist provides music while individuals simply listen. The second is referred to as ***active MT***, in which individuals are expected to participate in the production of the music by playing instruments, singing, and/or dancing (Ingram, 2012).

Differentiating between ***music therapy*** and ***music activities*** studies is not straight forward. Music therapy requires clear theoretical and applicative bases along with methodological and scientific objectivity in research design. In addition, some empirical studies conducted by music therapists were music activity studies, and the concept of music therapy also differed according to cultural contexts (McDermotto, Crellin, Rider, & Orrel, 2013).

The systematic reviews found evidence for short-term improvements in behavioral and psychological disturbance. The limited availability of high-quality studies and the lack of evidence for long-term benefits of music therapy also highlight the

difficulty of finding appropriate outcome measures to evaluate a complex intervention for people with dementia (McDermotto, Crellin, Rider et al., 2013).

Review of Music Therapy: Dowse (1996) introduced the following personal episodes; *It was like switching on a light. As soon as the individual or group music sessions commenced, many of the residents "came alive", singing or whistling, shaking small hand-held percussion instruments, and moving hands and feet rhythmically. Whenever I visited the participants' dayroom, the residents were sitting in a state of total apathy, were asleep or in the case of one or two, muttering to themselves. The behavior observational data highlighted the marked contrast between the participants' behavior in the music session and the dayroom.*

In an investigation of the use of music to retrieve long-term memories, ix thirty-minute sessions were given to twelve residents of two nursing homes, diagnosed as having Alzheimer's disease. Two of the sessions used musically cued reminiscence; two sessions were spent in verbal reminiscence without music; two sessions consisted of familiar songs. The results for the musical activity were statistically significant (Dowse, 1996).

People with Alzheimer's dementia was examined for verbal recall, with and without music. the music encouraged responsive participation (singing, humming, and tapping) and those words in a musical context facilitated recall more than words without music (Dowse, 1996).

The use of drums was investigated with individuals in the advanced stages of dementia. Group drum playing helped to access their inherent sense of rhythm. The rhythms were varied over time, however their repetitive and predictability nature provided a stable base for a positive participatory activity (Dowse, 1996).

Music therapy sessions provided one of the only opportunities in which low-functioning patients could interact successfully with others. The effects of recorded music in decreasing occurrences of aggressive behavior were observed among the patients with dementia during bathing episodes. Caregivers reported improved affect and a general increase in cooperation with the bathing task in response to music. Several caregivers had successfully used music to calm individual agitated patients. However, uncontrolled sound could cause agitation in other patients and stress in the nursing staff (Oshima, Nakayama, Yasuda et al., 2010).

An experiment was conducted in which individuals with dementia listened to their preferred music. The results showed that mean agitation levels were significantly lower during than before listening. The study of Nair et al. found that ambient Baroque music did not have a calming effect. Therefore, in order to achieve the desired behavioral effect, music may need to be tailored rather than generalized (Oshima et al., 2013).

Effectiveness of Music Therapy (McDermotto, Crellin, Rider et al., 2013): Literature reviews on music therapy in dementia conducted to date have found short-term reductions in behavioral disturbance and improved mood, but evidence for long-term benefits is lacking. conducted narrative synthesis (NS) systematic review of literature on music therapy in dementia.

Group music therapy may encourage social interaction between group members, thus reducing social isolation and assisting in communicating feelings and ideas. Fundamentally, music making is non-verbal, and this offers an alternative means for self-expression and communication when the conventional use of language becomes difficult. Music accessible medium for people with dementia. However, despite the wealth of music and music therapy literature in dementia care, there are no in-depth reviews exploring the mechanisms of music therapy interventions.

Short-term intervention was offered and found that it was still effective in reducing agitated behavior and pacing. However, this study had a particularly high number of participants excluded from analysis; therefore, the degree of evidence is questionable. Reduction in wandering behavior was also reported in studies, however, the studies' quality was too low to draw any conclusion.

A long-term effect of music therapy on agitation was investigated, but this could not be established because of the large variation between the treatment and control groups and fluctuating Cohen–Mansfield Agitation Inventory scores.

The small-group intervention focusing on reminiscence using familiar songs was effective in reducing depressive

symptoms. There was a significant improvement in the Cornell Depression Scale scores; however, provision of daily music therapy is not a common practice in most clinical settings. Hence, the positive results might not have been typical.

Six studies were examined for hormonal and physiological changes observed following music therapy. Musically medicated stimulation of several neuro-hormonal and neurotransmitter systems is hypothesized to be able to accompany behavioral changes. Physiological changes related to music therapy were evident. Improvement in heart rate variability was reported and decreased heart rate was also documented. Increased melatonin concentration was associated with a calmer mood amongst the patients, and reduction of stress hormone was observed.

Two before-and-after studies explored effects of music therapy on the relationships between family caregivers and their family members with dementia. The interventions consisted of a series of structured music activities, but theoretical explanations for the choice of these particular activities were not provided for either studies.

Providing music therapy during the day had a positive influence in increasing the cognitive ability of person with dementia the following morning. Another study analyzed the reaction either to live interactive music, passive pre-recorded music or silence for 30 minutes. The visual image of someone playing provokes a greater emotional response.

The influence of music therapy was investigated on people with moderate to severe levels of dementia. Results show increased communication in the group that received the therapy. Music appeared to have significant positive effects for people with cognitive impairments. Many of those with Alzheimer's disease, despite aphasia and memory loss, continued to remember and sing old songs and dance to old tunes. Music is an important source of social cohesion and social contact so supporting its inclusion within and outside the household provided a degree of empowerment for Person with dementia (Carswella, McCullagha, Augustoa et al., 2009).

A significant improvement was found on the language subscale of the MMSE in the MT group. There is suggestive evidence that MT has a positive impact on speech content, speech fluency and category fluency in adults with VD and DAT. Following MT, improvements have also been noted on the language subscale of the MMSE.

Systolic blood pressure increases with aging; the systolic blood pressure was significantly lower in participants who received music therapy. No significant differences in cortisol level in saliva or intelligence assessment score were observed (Takahashi,& Matsushita, 2006).

RCTs study and narrative study for Music Therapy (McDermott, Crellin, Ridder et al., 2013): Randomized controlled trials (RCTs) provide more reliable evidence in evaluating healthcare interventions. However, RCTs are not always the most suitable research design for psychosocial interventions because provisions of double blinding to treatment or placebo condition are not always practically possible or ethically suitable. Individual cases are explored in more detail in qualitative studies or in single-case studies, but these studies are automatically excluded from standardized quantitative meta-analysis.

Traditional narrative reviews may offer more flexibility to accommodate various study designs; however, these reviews can be seen as less trustworthy if review methods such as inclusion and exclusion criteria or quality assessment of studies are not made explicit.

Various forms of narrative synthesis (NS) are widely used in systematic literature reviews. However, NS has been criticized because of the lack of consensus on its constituent elements. A guide was devised a guide to make the process of NS more systematic and to minimize bias. NS can still include the statistical analysis of the findings, but the key to this approach is not only to review what worked but also to investigate why and how an intervention might have worked.

One important limitation is the small sample size that was included in these studies. In addition, the Music therapy interventions described in each study took place over a short period of time and no long-term effects were reported. Another limitation of current Music therapy research is the loose clinical definition of Music therapy. As a result of this, there is very little consistency in experimental methodologies. In addition, the definition of Music therapy does not distinguish between active and receptive forms of the therapy.

A further limitation of the research included in this critical review is that participants had varying types of dementia (i.e.,

Vascular dementia or Alzheimer's dementia). As well, no information regarding the severity of the dementia was provided. A more random sampling to obtain participants would be necessary in order to increase the generalizability of the results.

Review of Music Therapy by applying ICT (Oshima et al., 2013): The ***Music Memory Lane*** system was constructed, which enables people with dementia to listen to and watch nostalgic music videos. This system had a positive impact in engaging people with dementia. ***Picture Gramophone*** are also systems that present old popular songs and display old video pictures. Alm, et al. constructed a hypermedia system ***CIRCA*** that allowed people with dementia to enjoy reminiscences using generic photographs and nostalgic music via interaction through a touch screen. When a patient with dementia touches a photograph on the screen of CIRCA, music suited to the photograph is presented. ***Express Play*** is a support system that patients with dementia compose music.

However, all of these systems are passive for the users. Topo, et al. described the ***Picture Gramophone*** when the user begins to sing along with the accompaniment, the lyrics appear on the screen and they are timed to scroll along with the music. ***ExPress Play*** promotes musical creativity in people with dementia, allowing them to create music actively. When the screen is touched, the user hears a chord play and sees circular shapes on the screen. People with mild to moderate dementia showed a positive engagement in the music activity. However, it is doubtful that they would enjoy this system on a daily basis.

Music Table system uses applications of augmented reality to the composition and learning of music for children. The children use cubes on the table, which are the input systems that start the sound. Cubes are considered to be familiar toys for children, so they are apt to touch the cubes without any directions.

7.2 Behavioral Guidance by Music (Yasuda et al., 2006)

There have been no previous reports of daily home activities of individuals with dementia being guided by the combination of music and verbal messages. This study evaluated the effectiveness for three individuals of music and messages which were automatically output by an IC recorder. After music was presented, messages instructed them to go to a day care center, behave more peacefully and eat more at meals, respectively. These stimuli were highly effective for guiding the above activities. This study suggests that automatic output of music and messages has potential as a strategy for guiding individuals with dementia at their home.

Clinical literature has also demonstrated the positive effects of toys, such as dolls and stuffed animals, on the behavioral symptoms of individuals with dementia. If music and messages are given through a doll, the combination of these stimuli can assist in management of various behavioral disturbances in more severe dementia. The third experiment in this study employed music and messages presented through a doll.

Experiment 1: Case KS: KS is a 71-year-old man with Alzheimer's disease who enjoys listening to famous classical music. In April 2001 he was attending a day center four times a week. However, he began to refuse to go to the center. His wife, therefore, persuaded him to go out by saying "Let's go for a walk with the dog" (intending to go to the center). This was always a very stressful process for her.

We hypothesized that if songs expressing an admiration of nature or a desire for travel were presented to him, he would be motivated to go for a walk. Therefore, we played him songs in the morning before he came to the center. Messages advising him to go for a walk followed the songs. Once he was dressed and ready at his door the car from the center would arrive to pick him up.

Three popular songs were chosen based on the following guidelines: They were oldies from 1930s to 1940s which he knew well, they were rhythmic songs with bright tunes, and the lyrics of songs expressed an admiration for nature such as the mountains and the sea. The messages and three songs were output automatically by the IC recorder from 8:30 to 8:41 a.m. on days he attended the center. His wife put the IC recorder in the living room and took it to the door as he prepared to leave.

In the baseline phase, his wife felt severe stress in 2/7 days (28.5%), and moderate stress in 5/7 days (71.4%) related to persuading him to go out. In the intervention phase, his wife felt mild stress in 2/17 days (11.7%) and no stress in 15/17 days (88.2%).

Behavioral disturbances observed in the day care center: From the beginning of the intervention, several staff members at the center reported to his wife that recently he had behaved quietly there. The staff at the center was unaware of the beginning of this

intervention. Before the intervention began, the following six behavioral disturbances were observed: “His speech becomes harsh at times”, “he was wandering around”, “he was restless all day” etc. After the intervention began, only one behavioral disturbance was observed: “He showed a stern expression at times”.

Caregiver’s (his wife) comments: Since the beginning of the intervention, he has obediently agreed to go out. Sometimes before the end of the songs, he would voluntarily stand up, and prepare to go out. As this was a very simple method which might apply to a child, I did not expect it would be so effective. I was very relieved by this intervention.

Discussion: In this experiment, the presentation of songs beforehand made the verbal messages effective for him. This appears to be due to his improved mood and increased motivation in response to the songs. Additionally, listening to the songs before coming to the day care center may have had a prolonged positive influence on his mood and resulted in a decrease in behavioral disturbances at the center.

Most music interventions, however, have been performed in hospitals or other in-patient facilities. It is quite difficult to perform at home because it adds to the work which must be done by caregivers. However, we postulated that the automatic output of music would not increase the caregiver’s workload. This study was the first attempt at bringing music intervention into the home utilizing the automatic output function of the IC recorder.

Experiment 2: Case TA: TA is a 68-year-old man with vascular dementia. Since the summer 2001, he had begun to repeat himself, to get excited easily, and to be verbally abusive to his wife. However, he complied with other’s instructions (e.g. nurses). After he hit his wife with his cane in July of 2002, a sedative was prescribed. However, he continued to verbally abuse his wife occasionally, which was very distressing to her. We hypothesized that the intermittent presentation of songs and messages would reduce his verbal abuse.

Ninety-six children's songs were prepared. These songs were evaluated by an amateur composer in regard to two factors: familiarity and non-excitement. In this manner 28 familiar and non-exciting songs were selected for the intervention. Four songs (about ten minute’s total) were grouped as a set. Ten sets (three sets were used twice) were output from 8:15 a.m. to 5:30 p.m. Each set was automatically played at one-hour intervals. At the beginning of each set, and at the pauses in a set, the first author’s messages were output. At the end of the set, the message asked him to behave quietly, peacefully, etc. (see Appendix 2).

In the baseline phase, there were six incidents of verbal abuse in 11 days (54.5%). After the intervention began on August 12, the frequency of verbal abuse was reduced to 3 times in 21 days (15%)

Caregiver’s (his wife) comments: He has settled down since the intervention began. He would stop talking when the music started. One day we were quarrelling over trifles. Just in time, the music started automatically. As his attention turned to the songs, his anger quickly disappeared. After a set of four songs ended, he often requested more. I felt that music was more effective than the sedative in making him settle down.

Discussion: Verbal agitation is a common behavioral disturbance in dementia, including screaming, calling out, moaning etc. Since the intervention started, TA has become gentler and has almost ceased verbally abusing his wife. This was accomplished by the presentation of music once an hour. To our knowledge, automatic intermittent presentation of music has not been previously tried.

Casby and Holm (1994) examined the effect of classical music and favorite music on the repetitive disruptive vocalizations of three individuals with Alzheimer’s disease. In their study music significantly decreased the number of vocalizations for two of three individuals. Several other researchers have also noted the effect of music on verbal agitation in dementia. The results of experiments 1 and 2 in this study are consistent with these reports.

Experiment 3: Case SI: SI is a 75-year-old homemaker with Alzheimer’s and vascular dementia. Since the second infarction, her meal intake had been decreasing. In April 2002, the average amount was 20-30 percent of the meal served.

In the speech therapist’s room, she was able to listen to children’s songs for 30 minutes or more. We had also showed her a doll, whose head she would stroke gently, saying “you are pretty.” We hypothesized that music and messages played through a doll

would be an effective way of encouraging her to increase her intake at meals.

The Sony IC recorder was stored in a pocket set on the back of the doll's clothing. Thirty-eight minutes of songs and messages which encouraged her to eat were recorded on the IC recorder. The tape consisted of 6 repetitions of a female piano teacher singing a children's song. The original lyrics of the song were replaced with new ones, which recommended that SI eat more. About two minutes of silence were inserted between repetitions. The same melody without the lyrics was also played 6 times, each repetition separated by two minutes of silence. At the beginning and end of every song or melody were messages spoken by the piano teacher encouraging SI to eat.

The average amount of intake was 26% in the baseline phase. In the intervention phase, it increased to 54% on average.

Caregivers' (her husband and son) comments: She answered the messages from the doll. For example, in responding the message "This rice is newly harvested." she answered "Is it true? I am very glad." and to the message" You were scolded when you hadn't eaten every grain of rice in your childhood," she replied "That is true." She spoke to the doll more than to us. She became happier when she listened to these stimuli.

Discussion: Ragneskog et al.（1996） has investigated the influence of dinner music on food intake by individuals with dementia. They found that individuals ate more in total during music periods. In our experiment, messages were added to the music, and were provided through a doll. This intervention also succeeded in increasing the amount of the meal consumed.

This individual's decreased appetite was considered to be mainly the result of her depressed mood and advanced dementia (Ragneskog et al., 1996）. As for the effects of dolls or toys on depression, Francis and Baly (1986) found statistically significant improvements occurred on most variables including depression, mental status, positive emotion, and social interest when plush animals were provided. Furthermore, four individuals with Alzheimer's disease produced more information units when dolls and stuffed animals were present (Hopper, Bayles, & Tomoeda, 1998).

When messages were output through the doll, SI responded to the "speaking doll" as if she were a real conversational partner. Just like joyful conversation over a meal, the artificial conversation with the doll improved her appetite.

General Discussion: Although music has been suggested as a means for directing people with dementia (Casby & Holm, 1994; Gerdner & Swanson, 1993; Goddaer & Abraham, 1994), music therapy has been applied primarily for the purpose of group recreation in skilled nursing facilities (Bright, 1987). To our knowledge, this is the first investigation to use the automatic output of songs and messages for directing individuals in their homes. There are many people with dementia who refuse to go to their day care centers, do not eat enough at meals, or are easily agitated. The results of this study indicate that the automatic output of music and messages is a highly successful method for guiding people with behavioral disturbances. In practical terms, this method holds great promise, since it can easily be applied to other activities of daily life, such as bathing, toileting, etc.

Music appears to alter the abnormal or disruptive behavior of people with dementia (Casby & Holm, 1994). It is important to select music that coincides with patient's preferences if one expects treatment to be effective (Cook, 1981).

This study suggests that music can have a strong effect on mental stability. Bright (1987) has suggested that the behavior of individuals with dementia was not only "better" during the music session but continued to be "better" for a time afterward, indicating some carryover effect. In this study the stabilized mental state brought to our three cases by the intervention seemed to continue for hours.

It is known that some individuals with dementia show the "doll phenomenon". That is, they cherish dolls as if they were genuine babies. As a result, a doll is likely to be effective as a messenger or a conversational partner.

Interventions should be directly focused on situations of daily living (Adam et al., 2000), especially in their home. Because the methods used in this study were focused on daily activity, our individuals and caregivers received immediate benefit.

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