

ORIGINAL RESEARCH

REVIEWING THE ROLE OF MUSIC IN THE MANAGEMENT OF AGITATION IN PEOPLE WITH ALZHEIMER'S DISEASE: CAN IT BE ADDED TO THE OCCUPATIONAL THERAPY TOOLKIT?

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ABSTRACT

Purpose: This review explores the current use of music in the management of agitated behavioural symptoms of Alzheimer's disease (AD) and dementia, the effects of music on these symptoms and the potential therapeutic use of music in the context of occupational therapy. **Methods:** A literature search was conducted using the keywords 'Alzheimer's disease', 'dementia', 'agitation', 'behavioural symptoms', 'music' and 'music therapy'. Databases searched were: Medline, CINAHL, Ovid, OTDBase, OT Seeker, PsychINFO and Cochrane Database of Systematic Reviews. Secondary sources were identified using a forward search from key articles. For inclusion, articles needed to be published in English and peer reviewed. Articles were restricted to those exploring music and/or music therapy for management of agitated behaviours in AD or dementia and have clinical relevance to occupational therapy. Databases were searched for articles between January 1990 and June 2010. **Results:** 32 articles were identified in the primary search. A total of 16 research based articles met criteria and are included in the review. One research article was published by an occupational therapist (Casby & Holm, 1994). In addition, eight literature reviews and one Cochrane review were identified. Publications excluded from this review included: two articles not available in English; seven articles exploring topics not relevant to the review; one article due to uncertainty if participants had dementia; and three articles not targeting agitation as an outcome of the intervention. Multiple authors have found substantial improvements in behavioural symptoms of dementia using musical interventions, although many of these studies have methodological limitations. **Conclusions:** Despite sufficient evidence to warrant the use of music as a creative, individualised and non-pharmacological strategy for the management of behavioural symptoms of AD, to date there is little documented evidence on the use of music by occupational therapists working in dementia care. The potential for music to improve participation and function in daily life, reduce caregiver stress and enhance wellbeing suggest music could substantially add to the occupational therapists tool kit.

KEY WORDS: Dementia; Alzheimer's disease; Music; Occupational Therapy; Agitated behaviour.

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INTRODUCTION

Alzheimer's disease (AD) is a degenerative disease of the brain that has a profound and debilitating impact on all aspects of a person's life. AD is the most common form of dementia accounting for approximately 60% to 80% of cases (Access Economics, 2009; Alzheimer's Association, 2009). The prevalence of dementia increases with age and doubles every five years over the age of 65 (AIHW, 2004). Current population trends indicate that between 2000 and 2050, the number of people in Australia with dementia is expected to increase by 327% to reach 731,000 (Access Economics, 2005). During this time, the total population is likely to increase by less than 40% (Access Economics, 2005).

In 2002, the total cost of dementia was estimated to be \$5.6 billion including direct health care expenditure (\$3.2 billion), family and caregiver costs (\$1.7 billion), and expenses due to loss of productivity, environmental modifications, assistive devices and community care (Access Economics, 2004). This is expected to increase to \$8.2 billion by 2022-2023 (Low et al., 2008) and reach a total of 3.3% of Australia's GDP (gross domestic product) by 2051 (Access Economics, 2003).

The provision of care for people with AD is affected by the development of behavioural symptoms such as agitation (Cardona et al., 1997). Agitation is defined as "inappropriate verbal, vocal or motor activity that is not explained by needs" (Lou, 2001) and is one of the most difficult behavioural symptoms of AD to manage. Moderate to severe agitation exists in 40% of individuals with AD (Lechowski et al., 2003) and presents major challenges for the individual, caregivers, health services and the community (Finkel, 2003). Agitated behaviours compromise the health, safety and wellbeing of people with AD and are a source of physical and emotional stress for the individuals, their carers and their families (Lou, 2001). Agitation also interferes with nursing and medical assessment. Agitation contributes to higher caregiver morbidity, premature placement in residential care facilities (Maas et al., 2004) and increased demand on health services (Finkel, 2003).

Cohen-Mansfield and Billig (1986) identified four subtypes of agitation: physically non-aggressive; verbally non-aggressive; physically aggressive; and verbally aggressive behaviours. Specific behaviours are listed in Table 1.

Table 1: Four subtypes of agitation: physically non-aggressive; verbally non-aggressive, physically aggressive and physically non-aggressive.

Physically non-aggressive behaviours	Verbally non-aggressive behaviours
General restlessness Repetitive mannerisms Pacing Trying to get to a different place Handling things inappropriately Hiding things Inappropriate dressing or undressing Repetitive sentences	Negativism Does not like anything Constant requests for attention Verbal bossiness Complaining or whining Relevant interruptions Irrelevant interruptions
Physically aggressive behaviours	Verbally aggressive behaviours
Hitting Pushing Scratching Grabbing things Grabbing people Kicking and Biting	Screaming Cursing Temper outbursts Making strange noises

Classification of Cohen-Mansfield & Billig (1986)

Psychological, biological and environmental factors can influence the degree to which these behaviours are manifested (Finkel, 2003). Predictors of agitation include demographic and environmental backgrounds, health status and genetics (Auchus et al., 1996). The accurate identification of factors contributing to behavioural disturbance is fundamental for the development of successful strategies to reduce or eliminate such behaviour.

Pharmacological management of behavioural symptoms of dementia has not yet proven effective (Sink et al., 2005). There is some evidence to suggest that cholinesterase and glutamate inhibitors may reduce the symptomatic progression of AD (Birks, 2006; Reisberg et al., 2003) and provide some benefits to cognition and function (Sink et al., 2005). Multiple adverse effects can exist for other pharmacological agents (antipsychotic, antidepressant and mood stabilising medication) which include extrapyramidal symptoms and sedation (Sink et al., 2005), an increased rate of cognitive decline (Herrmann, 2000; Ellul et al.,

2007), incontinence (Starr, 2007) and an increased risk of falls leading to further complications (Allen, 1999). Primary or concurrent use of non-pharmacological approaches is recommended to reduce the "dosage, duration or complexity of treatment" (Cummings and Frank, 2002).

The generic role of occupational therapy in dementia care is well established, however Paterson and colleagues (2000, p.135) suggest that "therapists would benefit from a greater understanding of how to effectively manage and reduce behaviour problems that are affecting occupational performance". A variety of non-pharmacological strategies to address behaviours such as agitation have received attention in nursing literature (listed in Table 2), however there is a paucity of occupational therapy literature investigating the implementation, effectiveness and potential occupational therapist role in such interventions, including the use of music.

Table 2: Non-pharmacological strategies for managing agitation in people with dementia.

Strategy	Description	Reference
Caregiver education	Provides caregivers with techniques to manage client behaviour using written material, support groups or individual consultation.	Robinson, Adkisson & Weinrich, 2001
Social and diversional therapy	Facilitated daily activities to promote participation (eg exercise groups, cooking, spiritual therapy, trips & craft)	Pulsford, 1997
Validation therapy	Cognitive approach to empathise & acknowledge anxiety & confusion. May reduce the number of conflicts between carers & individuals. Sustained benefits not proven.	Deponte & Missan, 2007
Reminiscence therapy	Reviewing life events using discussion, photographs or familiar items. Potential for improvement in mood, cognition and function.	Woods et al., 2005.
Simulated presence therapy	A highly-individualised program which gathers important memories & transfers them onto interactive audiotapes simulating a telephone conversation. Efficacy not yet proven. Important to assess suitability and responses to treatment.	Camberg et al., 1999 Zetteler, 2008
Psychotherapies (individual & group)	Assists with anxiety related to the diagnosis & anticipated functional decline in AD. Can provide peer support. Benefits can remain for several days even if the session cannot be recalled.	International Psychogeriatric Association, 2002
Snoezlen	Combined psychological and sensory stimulation for individuals to explore an environment rich in tactile, auditory & visual stimuli at their own pace. Increasingly used by OTs to manage behavioural symptoms of AD. Efficacy not yet proven.	Chung & Lai, 2002
Alternative therapies	Alternative therapies eg aromatherapy, touch therapy, reflexology, massage, hydrotherapy, colour therapy, horticulture, light and animal-assisted therapy are being assessed for their efficacy.	Burns et al., 2000 Australian Government Department of Health and Aging, 2003
Montessori-Based Interventions	Interventions aimed to facilitate participation & accomplishment in activities by creating an individualised, sensory-based environment using task adaptation or grading.	Munn, 2008
Community based therapy	Home-based occupational therapy for participants and care givers. Can improve activities of daily living & feelings of competence in care givers.	Graff et al., 2006

RESULTS

Music Therapy and Music Interventions

'Music therapy' and 'music' are two distinct treatment modalities which have been explored in gerontology and nursing literature in the last two decades, emerging as promising tools to assist in the management of agitation. 'Music therapy' is an active participatory process whereby a trained music therapist tailors musical interventions to meet an individual's needs or goals (Vink et al., 2003). The music is used as a non verbal strategy to support communication, emotion and development of rapport (Raglio and Gianelle, 2009) by improvising in response to an individual's verbal and non verbal cues and their degree of engagement with an activity (Paul & Ramsey, 2000). 'Music' is

considered exposure to a musical stimulus without a direct requirement for active participation from the listener.

Of the 16 articles included in this review, 12 articles explored the effects of music and 4 investigated music therapy (Table 3). Ages of participants ranged from 55 years to 101 years. The majority of studies used a quasi experimental design with participants acting as their own control. Both music and music therapy interventions were found to be effective in reducing agitated behaviour.

Music therapy

Music therapy intervention was investigated in four research articles with favourable results reported (Table 3).

Table 3: Summary of Reviewed Articles

Author/Year	Sample/Setting	Design	Intervention	Instrument	Data Analysis	Outcome	Rating*
Music Therapy							
Groene 1993	Alzheimer's unit n=30 60 – 91 years (mean 77.5 years)	Experimental (Two group, two treatment repeated measures) Random allocation	Music therapy (included listening, playing percussion instruments, singing, movement/dance) Reading sessions reading aloud to participant 1 session per day for 7 days (5 music/2 reading or 5 reading/2 music) 15 minute sessions	Wandering behaviour measured by pedometer, mercury counter and cyclometer readings MMSE	Descriptive t test/within group ANOVA	Participants remained seated for longer for music therapy sessions No difference in cognitive scores	1b
Raglio et al. 2008	n=59 73 – 94 years	Randomised controlled trial	Music therapy <i>Intervention Group:</i> 16 weeks (30 music therapy sessions, 30min/session) <i>Control Group:</i> Educational support or entertainment activities	MMSE, Barthel Index, NPI Therapy sessions videotaped & reviewed by 2 independent observers Agreement by Cohen <i>k</i> (<i>k=0.67</i>) Behaviours categorised using some items of the Music Therapy Coding Scheme	Descriptive Mixed analysis of variance NPI item scores Friedmann's analysis of variance	Significant decrease in NPI score in experimental group Specific behavioural symptoms significantly improved	1b
Svansdottir & Snaedal 2006	2 nursing homes 2 psychogeriatric wards n=38	Randomised controlled trial	Group music therapy sessions conducted by qualified music therapists (3-4 subjects/session) <i>Intervention group</i> 18 sessions over 6 week period 30 minute sessions <i>Control group</i> Usual care	BEHAVE-AD Rated at baseline, following intervention & 10 weeks post intervention	Descriptive Wilcoxon Sign Rank test	Significant reduction in agitated behaviour	1b-

Author/ Year	Sample/Setting	Design	Intervention	Instrument	Data Analysis	Outcome	Rating*
Choi et al. 2009	Dementia day unit n=20 Mean age 77.2 years	Quasi- experimental Non random allocation to music group or usual care	Music therapy sessions 3 sessions per week, 5 consecutive weeks 50 minute sessions	MMSE GDS GQoL NPI	Descriptive Paired t-tests	Significant improvements were seen in depression and quality of life in the intervention group	2c
Music							
Clark et al. 1998	Nursing home n=18 55-95 years	Experimental Random allocation	No music or preferred music played during bathing on tape recorder Intervention for 2 weeks Subjects crossed- over 2 weeks	Trained research assistants used a researcher designed checklist to measure aggressive behaviours during bathing. Reliability/validity not reported. Inter observer agreement >0.90	Descriptive t-test	Significant decrease in aggressive behaviours with preferred music. Improved cooperation and mood of patients reported by caregivers.	1b
Sung et al. 2006	Residential care facility n=32 >65 years	Quasi- experimental Random allocation	<i>Intervention group</i> Preferred music played mid-afternoon. 30 mins; 2 days/wk 6 weeks <i>Control group</i> Usual care	CMAI	t-test	Significant reduction in overall agitation & physically nonaggressive behaviours in the intervention group.	1b-
Denny 1997	Long term care facility n=9 65-84 years (mean 74.8 years)	Quasi- experimental one group repeated measure Wk 1 & 3 – no music Wk 2 & 4 – music	Classical music played above background noise level during lunchtime (in dining area) Duration 4 weeks	Modified CMAI ** used by observer to record behaviour on the last day of each week.	Descriptive No significance testing undertaken	Agitated behaviours decreased with music; remained slightly below baseline following withdrawal of music and were again substantially reduced with the reintroduction of music.	1c
Gerdner 2000	6 long term care facilities n=39 70-99 years (mean 82.6 years)	Experimental Random allocation to 2 matched groups	<i>Group A</i> 6 weeks individualised music played on audio cassette 30 mins; 2days/wk 2 weeks no music (washout) 6 weeks classical music 30 mins; 2days/wk <i>Group B</i> Type of music reversed	Modified CMAI used to assess behaviour at baseline, during intervention and washout periods.	Descriptive ANOVA	Decrease in agitated behaviour was significantly greater for individualised music than classical music	1c

Author/ Year	Sample/Setting	Design	Intervention	Instrument	Data Analysis	Outcome	Rating*
Clair & Bernstein 1994	Hospital unit n=28 56-81 years	Quasi- experimental One group repeated measure	3 background music conditions: no music; background music; sedative background music Played in dayroom Each condition played 30 minutes, 3x day for 10 days.	3 trained observers recorded the number of participants demonstrating agitated behaviours at 1 minute intervals during 30 minute intervention. Tool not specified Inter-rater reliability coefficient 0.93 – 0.97	Descriptive t-test, ANOVA	No significant decrease in agitated behaviours in any of 3 conditions	2c
Gerdner 2005	Care facility n=8 77-95 years (mean 83.3 years)	Quasi- experimental	Individualised music played on CD player at previously determined peak agitation times, & on an 'as needs' basis for 8 weeks Cross-contamination avoided	Investigator modified version of CMAI and AVAS Inter-rated agreement 95%	Descriptive Linear mixed model for repeated measures analysis	Significant reduction in agitation	2c
Hicks-Moore 2005	Special care unit n=30 70-101 years (mean 82.4 years)	Quasi- experimental	<i>Week 1</i> Baseline data No music <i>Week 2&4</i> Relaxing music just above ambient noise During evening meal <i>Week 3</i> No music	Modified CMAI **	Descriptive	Reduction in agitated behaviours observed when music played.	2c
Ziv et al., 2007	Care facility n=28 Mean age 82.6 years	Quasi- experimental	Background stimulative music of well known songs played on CD for total of 16:48 minutes 1 day per week/3 consecutive weeks	Researcher designed observation form adapted from Cohen- Mansfield and Billig/unpublished form from care facility to rate behaviours as 'positive', 'negative', and 'neutral'. Observations conducted using 'momentary time sampling technique' Inter-rater agreement reported between 80% - 100%	Descriptive Paired t-tests	Significant increase in positive social behaviours Significant decrease in negative behaviours when music played.	2c
Gerdner & Swanson 1993	Care facility n=5 70-99 years	Case reports with intervention	<i>Week 1</i> Baseline data for each participant <i>Week 2</i> Preferred background music 3-30 to 4pm Observed 4-5 pm	Modified version of CMAI (modification not described)	Descriptive	Decrease in agitated behaviours during the intervention and the following hour.	4

Author/Year	Sample/Setting	Design	Intervention	Instrument	Data Analysis	Outcome	Rating*
Casby & Holm 1994	Care facility n=3 69-87 years	Case series with intervention	A-No intervention B-Relaxing classical music C-Favourite music Case 1 – ABCA Case 2 – ACA Case 3 – ABA Music played on cassette 2 x 10 min per day for 4 days at peak behaviour time	Tally of vocalisations in 10 second intervals for 10 minutes in each phase	Descriptive Bartlett's test for autocorrelation coefficient Bloom's probability table	Significant decrease in disruptive vocalisations in 2 of the 3 subjects	4
Gerdner 1997	<i>Case 1</i> Day centre Female, 89 years with Alzheimer's disease with severe cognitive impairment <i>Case 2</i> Care facility Female, 77 years with probable Alzheimer's disease with severe cognitive impairment	Case reports	<i>Case 1</i> Preferred music Played individually in a quiet room Audio cassette 30 minutes, 2 days/wk 15 sessions total <i>Case 2</i> <i>Stage 1</i> Classical music 30 minutes, 2 days/wk for 6 weeks <i>Stage 2</i> 2 weeks no music <i>Stage 3</i> Preferred music 30 minutes, 2 days/wk for 6 weeks	Observation of any behaviour change (qualitative) Modified version of CMAI (modification not described)	Descriptive Descriptive	Positive behaviours were noted (dancing, humming, clapping). No attempts to leave area during the music. Small decrease in behaviour with classical music. Decrease in agitated behaviour with preferred music.	4
Ragneskog et al. 2001	Nursing home n=4 77-84 years	Case series	<i>Session 1</i> No music <i>Session 2</i> No music - relaxing music - no music <i>Sessions 3&4</i> No music - individualised music - no music 4-5 observations made per participant, per session Videorecorded Session 30-45 mins	Video recordings analysed in 1 minute intervals using systematic observations & the Facial Action Coding System (reliability & validity not reported)	Descriptive	Some reduction observed in agitated behaviour	4

Articles are listed chronologically in rating order within each group.

*The Oxford Centre for Evidence-based Medicine Levels of Evidence Rating Scale (Oxford Centre for Evidence-based Medicine 2009, University of Oxford, 22 September 2010, <www.cebm.net>.)

**Goddaer & Abraham, 1994

MMSE, Mini Mental State Examination; NPI, Neuropsychiatry Inventory; GDS, Geriatric Depression Scale; GQoL, Geriatric Quality of Life; BEHAVE-AD, Behavior Pathology in Alzheimer's Disease Rating Scale; CMAI, Cohen Mansfield Agitation Inventory; AVAS, Agitation Visual Analog Scale

Music therapy interventions were typically presented as group sessions, varying in length from 15 to 50 minutes. Music therapy sessions were conducted by trained music therapists. The specific content of the sessions were inconsistently described

however included listening to music being played, playing musical instruments (including percussion), singing and dancing.

Svansdottir and Snaedal (2006) reported significant reductions in agitated behaviour. These results were supported by Raglio and

colleagues (2009) who also reported improvements in agitation, anxiety, irritability and apathy. Choi and colleagues (2009) also found significant improvements in agitation, aggression, disinhibition and irritability. Groene (1993) found improvements in wandering behaviours in response to the music therapy sessions when compared with reading.

Music

The majority of studies investigated the effects of background music from a nursing perspective (Table 3).

Music interventions were typically presented as background music played at different times for participants. The use of preferred music was explored in five studies (Clark et al., 1998; Gerdner & Swanson, 1993; Gerdner 2000 & 2005; Ziv et al., 2007). These studies found a consistent reduction in agitated behaviours. Clarke and colleagues (1998, p.16) reported that there were "improvements in mood and more smiling, dancing, and clapping in time to the music. Some subjects seemed calmer, and a general increase in cooperation with the bathing task also was reported".

In addition, three studies incorporated both individualised and non-preferred music into their investigations (Ragneskog et al., 2001; Casby and Holm, 1994; Sung et al., 2006). Studies also found positive benefits from background music played during mealtimes (Denney, 1997; Hicks-Moore, 2005) and during bathing activities (Clarke et al., 1998). In contrast, the use of sedative or stimulative music played during the day was investigated with one study finding little change in agitation observed (Clair and Bernstien, 1994).

Variability existed between studies in the type of music played (preferred music, relaxation, classical or stimulative music), the time of day and location that it was played (such as during mealtimes, bathing or at pre-determined intervals) and the duration of the music.

Therapeutic Use of Music for the Management of Agitation

Music and music therapy consistently appear to have benefits for behavioural symptoms of Alzheimer's disease and dementia. These results are mirrored by multiple literature reviews which have critically examined the use of these treatment approaches (Kneafsey, 1997; Lou, 2001; Sherratt et al., 2004; Sung and Chang, 2005; Wall and Duffy, 2010; Witzke et al., 2008). Methodological limitations are recognised as important factors to consider when interpreting results (Sherratt et al., 2004; Wall and Duffy, 2010) however the significance of current evidence remains widely acknowledged. Methodological limitations were related to poor descriptions of key indicators of validity (such as randomisation, blinding of intervention assessors, presentation/analysis of data and descriptions of interventions and procedures) (Vink et al., 2003).

The adjunctive benefits of music and music therapy have been described broadly in the aged care literature. Music may improve sleep patterns reducing the need for medication (Momhinweg and Voignier, 1995), increase melatonin levels (Suzuki et al., 2004), reduce physiological arousal (Norberg et al., 1986), encourage socialisation (Chavin, 2002), promote motor activity (Braben, 1992; Lindsay, 1993), enhance reminiscence and memory recall (Brooker, 1994; Lipe, 1992; McCloskey, 1990) and improve

communication (Ishizuka, 1998). These effects have been supported by health care professionals and family caregivers (Brotons and Marti, 2003) who have observed that music can promote a feeling of achievement, assist in language, and calm and reassure both the individual and their carer. It has been described as a unique component in the care of individuals with AD (Gerdner, 2000). Increasing attention has been given to rationales for the apparent effectiveness of music, from both a physiological and theoretical perspective.

Physiological effects of music

There is evidence that the body undergoes distinct physiological processes during exposure to a musical stimulus (Kumar et al., 1999; Suzuki et al., 2004). It is hypothesised that music modulates the release of hormones in the brain (Kumar et al., 1999). Specific hormone levels in body fluids can indicate raised degrees of stress or anxiety. Kumar and colleagues (1999) investigated the blood levels of hormones responsible for mediation of mood and behaviour (including melatonin, norepinephrine, serotonin and prolactin) following a music therapy session. Significantly increased levels of melatonin were observed following the intervention. These levels remained elevated six weeks later. Suzuki and colleagues (2004) used a similar method to study salivary chromogranin A (CgA), a chemical indicator of stress. Following the music therapy sessions, there was a decrease in CgA, indicating a reduction in the body's sympathetic stress response. Therefore music may contribute to a calmer mood and reduction in stress responses which lead to agitation. Furthermore, Takahashi and Matsushita (2006) explored the long term effects of weekly music therapy on the elderly with moderate to severe dementia over a two year period by recording salivary cortisol levels and systolic blood pressure. The authors concluded that there is a lasting effect on blood pressure and maintenance of physical and mental states.

Additionally, the genre of music influences neurophysiological responses. Baroque music encourages the production of alpha brain waves, leading to a calmer, more relaxed state of mind (Heim et al., 2003). Moreover, neural impulses generated by music are believed to counteract an endocrinological or sympathetic nervous system response to stress and agitation, resulting in a reduction in agitated behaviour (Remington, 2002).

Neurophysiology of the brain

Recent research attention has also focussed on exploring the way music is perceived and responded to, in the brain. The various musical components (such as rhythm, speed, timbre and melody) are believed to access different areas of the brain responsible for language, emotion and memory, including both the right hemisphere and limbic system, hypothalamus and prefrontal cortex (Wall and Duffy, 2010).

The pattern of cortical atrophy in AD follows a predictable sequence which differs from that of other forms of dementia (Murayama and Saito, 2004; Thompson et al., 2001; Thompson et al., 2003). Given that people with advanced AD maintain the ability to respond to music (Chavin, 2002), it is likely that the processing and emotional responses to music occur both cortically and sub-cortically "so that even in a diffuse cortical disease like Alzheimer's, music can still be perceived, enjoyed, and responded to" (Sacks, 2008, p. 385).

Theoretical Considerations

Theoretical constructs to support the apparent efficacy of music were notably lacking in the articles reviewed, with only four studies making reference to a theoretical framework (Denney, 1997; Gerdner, 1997 & 2000, Gerdner and Swanson, 1993). The Progressively Lowered Stress Threshold Model (PLST Model) (Hall and Buckwalter, 1987) and the Mid Range Theory of Individualised Music Intervention for Agitation (IMIA) (Gerdner, 1997) were used to describe and interpret study results.

Progressively lowered stress threshold model

The PLST model explores behaviour in the context of a person's ability to interact within the physical and social environment. The model suggests that people with dementia are less able to receive and process sensory stimuli, resulting in increased levels of anxiety which leads to a decreased stress threshold (Hall and Buckwalter, 1987). As the demands of the environment become too challenging, anxiety and stress progressively accumulate until this lowered-threshold is reached. Once the threshold is exceeded, behavioural symptoms such as agitation are manifested.

When viewed in the context of this model, music assists in controlling factors that contribute to elevated stress levels, thereby maintaining stress levels below an individual's threshold and reducing 'dysfunctional' agitation behaviour (Sherratt et al., 2004). Denney (1997, p.17) postulates that music "may create such a supportive milieu for patients with dementia, because it attenuates or buffers environmental noise, covering sudden, irregular sounds that patients, because of their cognitive decline, are unable to process or interpret as either familiar or benign".

Mid range theory of individualised music intervention for agitation

This theory proposed by Gerdner (1997) combines elements of cognitive impairment, agitation, the PLST model (Hall and Buckwalter, 1987) and individualised music interventions, to support the use of individualised music for reducing agitation. This theory proposes that agitated behaviours may be predictable when viewed in the context of the PLST model. Individualised music can promote an emotional association with memories and the presentation of individualised music can assist in reducing agitation for people with Alzheimer's disease and related dementias. The theory also proposes that individualised music is most effective when introduced before peak levels of agitation are reached and the personal significance of the music has a positive correlation with its effectiveness (Gerdner, 1997). The IMIA theory is further applied by Gerdner (2000) who reported that aspects of the mid-range theory were supported by her study and the use of individualised music was an important alternative approach to behavioural symptoms of dementia.

Other theoretical discussions of music as an intervention for behavioural symptoms of AD have focussed on the ability of music to communicate emotion. The ability to understand and communicate feelings and emotions is a core human need (Chavin, 2002; Papalia et al., 2001). This ability becomes disrupted by progressive cognitive deficits such as aphasia, apraxia and disturbed executive functioning (Australian Government Department of Health and Aging, 2003). Despite these deficits, the need to communicate emotion persists. Music is considered to have inherent emotional properties and the communication of emotion through music (in a non-AD sample)

has been found to be as accurate as interpreting an emotion presented vocally or facially (Juslin, 2003).

The listener can identify feelings and emotions through their orientation and interpretation of music (Sloboda and O'Neill, 2003). Manipulation of the technical elements of a musical score results in the expression of basic emotional categories, such as love, tenderness, happiness, sadness, anger or fear (Juslin, 2003). The tempo, intonation, articulation, volume, deviations in the timing of notes, melody and timbre determine how a piece of music is interpreted. Speed is the most important factor influencing expression, followed by rhythm, interval distribution, orchestral range, volume, mean pitch and melodic range (Gabrielsson and Lindstrom, 2003). For individuals with AD, preliminary evidence suggests that the most effective music to evoke behavioural responses is non-heavily percussive, culturally relevant and derived from their childhood and teenage years (Gerdner, 2000).

Other effects

While beyond the scope of this review, it is important to note that investigations into the effects of musical interventions for individuals with AD on carers have been scarce. It has been suggested that an intervention which decreases problematic behaviours for caregivers (such as pacing and crying), could indirectly contribute to lower levels of stress and burnout among the carers (Brotons and Pickett-Cooper, 1996). Brotons and Marti (2003) also suggested that a reduction in behavioural symptoms of AD combined with music therapy sessions designed specifically for caregivers could decrease their anxiety. Furthermore, the anticipated positive effects of an intervention may ease the stress and trepidation of caregiving duties by influencing the mood and attitude of the caregiver (Clark et al., 1998). For example, a typically problematic task such as bathing may be approached more positively by the caregiver anticipating that background music will assist in the management of agitation.

DISCUSSION

The Therapeutic Use of Music in the Context of Occupational Therapy

The complex neuro-pathological changes associated with the AD process profoundly impact on a person's health and occupational performance due to the altered functioning of sensory, perceptual, physical, cognitive and psychosocial skills. Occupational therapy theoretical models of practice such as the Occupational Performance Model (Australia) (Chapparo and Ranka, 1997), the Canadian Model of Occupational Performance (Canadian Association of Occupational Therapists, 1997; CAOT, 2002) and the Model of Human Occupation (Kielhofner, 2008) acknowledge the holistic representation of skills required for a person to achieve a positive state of health. These are the ability to: perform personally meaningful and satisfying tasks; actively engage within one's social, cultural, sensory and physical environments; and understand and feel a connection between one's body, mind and spirit, considered to be core elements of our being.

Ongoing opportunities to participate in personally meaningful activity have the potential to "maintain identity, provide a sense of usefulness and enjoyment, and, at least in the early stages of the disease, provide a respite from anxiety provoked by a decreasing capacity in the face of environmental demands" (Egan et al.,

2006, p.137). The development of behavioural symptoms further exacerbates participation limitations associated with Alzheimer's disease in all occupational domains (Egan et al., 2006), disrupts the typical physical, cognitive and psychosocial processes of late adulthood (Fraker and McKillop, 2000) and ultimately impacts on the health and quality of life for both those with the disease and their caregivers (Fraker and McKillop, 2000).

Music maintains a valued, functional role in late adulthood which provides opportunities for defining and redefining self identity, connecting with life experiences through reminiscence, maintaining personal wellbeing, alleviating boredom and loneliness, stimulating intellectual and imaginative thought, expressing inner self or conveying emotion and providing a feeling of 'contentment and security' (Hays, 2005). Hays (2005) also describes music as facilitating stress reduction, increasing competence in activities of daily living and maintaining cognitive and physical wellbeing.

Occupational therapists working with clients with Alzheimer's disease and other dementias focus on "supporting and stimulating occupational performance through individual and group interventions. Their primary goal is to optimize the client's ability to perform basic and complex activities of daily living and to create an environment that caters for the person's physical, emotional, and psychological needs" (Paterson et al., 2000, p.135). As the occupational therapist role is primarily concerned with identifying and promoting remaining skills for a person with AD, the potential functional improvements demonstrated following exposure to a musical stimulus is of specific interest to occupational therapists. Paterson and colleagues (2000) also acknowledge that modifying the environment to meet the individual's skills and to support participation in valued activities contributes to the effectiveness of behavioural strategies. The significant impact of agitation on both function and quality of life should therefore be addressed as part of a holistic intervention program. Although no studies have specifically examined the associated functional improvement following music or music therapy, results from several studies provide anecdotal reports of better maintenance of piano playing skills; the ability to sit for longer periods; the ability to recall material presented through song; increases in socially appropriate behaviours; maintenance of cognitive and emotional function; and greater contact with caregivers than previously (Chavin, 2002; Groene, 1993). Furthermore, individuals with AD were better able recall personal facts while music was being played (Larkin, 2001).

The use of music as an occupational therapy intervention was first discussed by Gaston in 1948 (Gaston, 1948). More recently MacRae (1992) suggested that OTs have a history of using music for pain management and motor, sensory and cognitive dysfunction, although much of this work remains undocumented. Despite this, only one study conducted by occupational therapists was identified which explored the effect of music on behavioural symptoms of dementia (Casby and Holm 1994). The efficacy of music is being increasingly recognised in a range of health care settings and has been used to manage pain and discomfort during medical procedures and assist in physical, cardiac and psychiatric rehabilitation (Paul and Ramsey, 2000). Occupational therapy models of practice complement theoretical constructs such as the PLST and IMIA models proposed in the literature, and occupational therapists are well placed to merge

fundamental theoretical perspectives of the profession with models supporting the use of music and/or music therapy in the dementia population. The holistic nature of occupational therapy provides a basis for further contributing to understanding of the effectiveness of music and further enhancing clinical and theoretical perspectives.

Music is considered to touch and promote the integration of the physical, psychological, spiritual, affective and aesthetic levels of consciousness (Kneafsey, 1997; Lou, 2001; MacRae, 1992) and may therefore be an appropriate method of emotional communication to enhance current behavioural strategies. This is of key importance when considered in the context of a dementia population. The characteristics of music may also encourage reminiscence by promoting episodic nostalgic thoughts that focused on "things and people not present" (Sloboda and O'Neill, 2003; Hays, 2005). This is important for an individual with AD because the disease impedes the recollection of emotionally significant memories and thoughts. Music can assist in the recollection of both pleasing and painful memories by catalysing reminiscence of "emotions, memories and private images" that the individual associates with the music (Gerdner, 2000). Sacks (2008, p.385) considers music to be a human necessity and for people with dementia he reports it "can have a power beyond anything else to restore them to themselves, and to others, at least for a while."

This review is limited by the fact that only articles of clinical relevance to occupational therapy practice were chosen and as such, only those data bases typically used by these professionals were accessed. In addition, the literature on this topic has been previously critically appraised from other perspectives and thus these publications were referred to rather than included in this review.

Future directions

Music appears to be a unique method of harnessing and facilitating the use of the remaining functional abilities of an individual with AD. Music's potential to not only reduce agitation, but also assist in the recollection of memories and emotions, reorient to the present as well as foster and support therapeutic relationships should not pass unnoticed. Further rigorous quantitative and qualitative research is required to promote the benefits of this intervention for occupational therapists working in aged care. Further exploration and development of theoretical frameworks addressing the efficacy of music in therapy is also necessary. The development of validated and reliable dementia-specific agitation measurement scales is required. Of particular importance are protocols for musical intervention, methods of musical presentation and detailed research into the extent and duration of physiological, behavioural, social and functional effects of a musical stimulus. Music appears to have great potential as an effective, non-pharmacological intervention for agitated behaviour. Further occupational therapy research is warranted because of the potential of music to offer many therapeutic benefits to families, caregivers and individuals with AD.

Options for occupational therapists to incorporate music into their clinical practice include (but are not limited to): exploring a person's musical history and preferences as part of holistic assessment; incorporating music into intervention planning (such as developing an individualised background music program);

organising opportunities to access musical instruments, particularly those that were played previously; educating families and caregivers on the potential benefits of engagement in music (both passively and actively); exploring theoretical frameworks that address the development of agitation in clinical practice, facilitating sing-a-long or group programs with a musical focus; and seeking opportunities to collaborate with trained music therapists.

CONCLUSION

Occupational therapists are uniquely placed to capitalise on the functional abilities that music may unmask for individuals with AD. The holistic nature of occupational therapy emphasises the importance of assisting these individuals to "maintain, restore, or improve functional capacity; to promote participation in activities that optimise physical and mental health; and to ease care giving activities despite physical, cognitive or psychosocial impairment" (American Occupational Therapy Association, 1994). Music and music therapy appear to have relevance as management modalities in holistically pursuing these goals. Music is nonverbal, creative, structured, purposeful and non-threatening and when utilised correctly it can foster interaction, communication, learning, self expression, self awareness and personal development (Canadian Association for Music Therapy, 1994).

Musical interventions could be used along the AD care continuum as a purposeful activity which embodies the traditional creative philosophy of occupational therapy. Music could provide occupational therapists with an additional tool to assist individuals to meet many important goals of care, as well as reach the non-tangible elements that form the basis of our sense of self.

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