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REVIEW ARTICLE



Use of multisensory stimulation interventions in the treatment of major neurocognitive disorders

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ABSTRACT

OBJECTIVE: Behavioral and psychological symptoms of dementia (BPSD) are a heterogeneous constellation of non-cognitive symptoms and behaviours that can cause significant patient distress and present complex management challenges. Behavioural and pharmacological treatments are used to decrease the symptoms, preserve function and increase quality of life. In the treatment of individuals with a major neurocognitive disorder, non-pharmacological interventions are often preferred as first-line treatment over pharmacological interventions, which often have modest efficacy, notable side effects and significant risks. Multisensory stimulation (MSS) interventions have become increasingly popular in the treatment of BPSD, particularly with disease progression. The objective of this review paper is to provide a brief overview of the types of MSS interventions currently used in the treatment of major neurocognitive disorders.

METHODS: Searches for papers published in this area were conducted using PubMed and the Web of Science Core Collection. The searches were done for the period covering the past 20 years, and key phrases used were “multisensory stimulation for treatment of BPSD,” “multisensory stimulation for treatment of major cognitive disorders,” “multisensory stimulation for treatment of dementia” and “multisensory stimulation for treatment of neurodegenerative disorders.”

RESULTS: Multisensory environments, multisensory tools and multisensory group therapies are discussed. There is growing support for the use of MSS interventions to improve mood, behaviour and quality of life in seniors with dementia and BPSD. However, currently the utilization of these interventions is highly variable and strong evidence for their use is limited.

CONCLUSION: MSS interventions in the form of multisensory environments, tools and group therapies present tremendous potential as first-line treatments or as adjuncts to pharmacological interventions in the treatment of major neurocognitive disorders. However, the body of quality evidence that currently exists is limited. A lack of evidence does not necessarily mean a lack of efficacy, and there is a pressing need for studies with improved power and study design to determine the effectiveness of specific MSS interventions and to ascertain for whom they may be most beneficial.

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Introduction

Behavioural and psychological symptoms of dementia (BPSD), particularly maladaptive behaviours such as pacing, exit-seeking, wandering, verbal aggression and physical aggression, affect the quality of life of individuals with dementia and their caregivers. Behavioural and pharmacological treatments are used to decrease the symptoms of BPSD, preserve function and improve quality of life. In individuals with a major neurocognitive disorder, non-pharmacological interventions are often preferred as first-line treatment [1,2].

Multisensory stimulation (MSS) interventions are becoming increasingly popular in the treatment of BPSD, particularly with disease progression [3]. MSS is listed in the NICE guidelines as a recommended intervention for patients with agitation in dementia

[4]. An MSS intervention is an intervention that stimulates two or more human faculties, via visual, tactile, auditory or olfactory stimuli. Despite increasing use, multisensory interventions are often used in an *ad hoc* manner without formal guidelines, and limited empirical evidence exists on their effectiveness [5]. Most studies on sensory stimulation focus on a single sensory stimulus such as music therapy, light therapy, massage, or aromatherapy [6–9]. For a comprehensive systematic review of available systematic reviews evaluating non-pharmacological interventions in the treatment of BPSD, please refer to the study by Abraha et al. [7]. In our paper here, we review the role of MSS in the treatment of major neurocognitive disorders. Multisensory environments, tools and group therapies are discussed.

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Silva et al. found no prior systematic reviews on the use of MSS in older adults with dementia [10]. Their subsequent systematic review in 2018 [11] focused on the effectiveness of MSS in managing neuropsychiatric symptoms (NPS) in older adults with major neurocognitive disorders. Silva et al. concluded that MSS interventions might be useful in the care of such older adults, but that their effectiveness in managing NPS requires further research and that no definite conclusions could be drawn on effectiveness due to heterogeneity of the studies [11].

Sensory equilibrium and dementia

As cognitive function deteriorates in dementia, the world is experienced with reduced ability to integrate sensory information and understand context [12]. Problem behaviours in dementia may occur because of sensory imbalances in the pacing of sensory-stimulating and sensory-calming activities [13]. Such imbalances can result from numerous factors including disturbances in circadian rhythm, neurophysiological decline, human intervention and environmental factors. Prolonged stimulation may exceed an individual's threshold, whereas prolonged lack of stimulation may result in sensory deprivation.

Sensory information is transmitted via neuronal networks to the brain, which interprets the internal and external environment [12]. With normal aging, a decline in sensory capacity for touch, smell, hearing, vision and taste is present. Sensory dysfunction promotes pathological disturbances in the locus coeruleus, basal forebrain, entorhinal cortex (ERC), hippocampus, key areas of the neocortex and brainstem [14]. Progressive neuronal loss in major neurocognitive disorders may also lead to impaired processing of sensory stimuli, making normal stimuli confusing and resulting in symptoms of BPSD [3]. Maintaining multisensory integration capabilities is a growing area of interest. Evidence suggests that despite deterioration in individual sensory systems, maintenance of or an increase in multisensory integration processing may be found in aging individuals.

Multisensory environments (MSEs)

MSS interventions have been used worldwide in dementia care with some evidence to support a positive impact in reducing BPSD, increasing positive behaviours, improving mood, facilitating interactions and communication and reducing caregiver stress [6,15–18]. Although randomized control trials (RCTs) are limited, Snoezelen is currently the most studied MSS intervention used in dementia.

Snoezelen combines the Dutch words “snuffelen” meaning to explore and “doezelen” meaning to relax [1]. Snoezelen originated in the Netherlands as a therapeutic intervention for individuals with severe learning

disabilities, aiming to provide an alternative to cognitive-based therapies [19]. Snoezelen is provided in a specially designed room filled with diverse multisensory stimulating materials including music, aromatherapy, tactile elements, fibre optic cables and water columns [5]. Although no current standard protocol exists, Snoezelen therapy involves one-to-one attention, a nondirective approach encouraging patients to engage with sensory stimuli of their choice, and does not require any cognitive processing [19].

A Cochrane review in 2002 concluded that there was no evidence of the efficacy of Snoezelen in dementia [20]. The review identified three acceptable RCTs in which Snoezelen or MSS programmes were used as an intervention for older adults with dementia but commented that the methodological quality of the trials was inadequate.

A recent systematic review by Lorusso and Bosch [1] looked at evidence regarding the use of multisensory environments as a treatment for BPSD and identified 12 studies [1]. Baillon et al. [15] conducted a crossover randomized control trial ($n = 20$) comparing Snoezelen to reminiscence therapy (using written and/or oral life histories to improve psychological well-being) and found that both interventions improved mood and behaviour; however, Snoezelen was not more effective than reminiscence in reducing agitation. Snoezelen was shown to have an advantage over reminiscence therapy in severe dementia, but the authors noted insufficient power in the study to provide conclusive evidence [15]. In a randomized control single-blinded study of 24 participants on a geriatric psychiatry unit where individuals received Snoezelen multisensory behaviour therapy (MSBT) or a structured activity, MSBT reduced apathy and agitation and improved activities of daily living in patients with moderate to severe dementia [21]. Maseda et al. published two studies [22,23] based on a randomized controlled, longitudinal between-group study of 30 participants divided into multisensory stimulation environment (MSSE) intervention, an activity group and controls. The first study found that MSSE sessions are as effective as activity sessions, with both groups having improved mood, behaviour and oxygen saturation and reduced heart rate. There was no significant difference between the MSSE and the one-to-one activity group [22]. The second study found that patients treated with MSSE had a significantly higher improvement in physical nonaggressive behaviour than those who attended one-to-one activities; however, no significant effects were found on mood, cognitive level or functional status [23]. In a paper on older adults with severe dementia ($n = 21$), Maseda et al. compared the effects of MSSE in a Snoezelen room and individualized music sessions [24]. Participants showed several significant immediate effects, including being more happy/content, talking more spontaneously, relating

better to people and enjoying themselves. Both interventions were effective in managing mood and behavioural disturbances in the short term and improving physiological factors such as heart rate and oxygen saturation in individuals with severe dementia. In a 24-week single-blind RCT pilot ($n = 18$) of MSS versus care as usual, Milev et al. found significantly improved behaviour in the intervention group compared to controls, and this is the only study to demonstrate long-term benefits of Snoezelen therapy at 12 weeks post treatment [25].

Collier et al. compared Snoezelen and indoor gardening ($n = 30$) and found significant improvement in motor and process scores in the Snoezelen group compared to the indoor gardening group [26]. A pilot RCT in older adults with severe dementia ($n = 32$) found that the MSSE group had significant improvements on the Neuropsychiatric Inventory and Bedford Alzheimer Nursing severity score compared to the activity group [27]. In a study on a small number of nursing home patients with dementia, Birkheimer et al. found results suggesting similar effects of Snoezelen and exercise in reducing agitation [28]. In a quality improvement project at the Good Shepherd Nursing home in Versailles, Minner et al. found that employees believed that Snoezelen therapy reduced behavioural symptoms and was a rewarding experience for residents and staff [16].

Cui et al. [29] hypothesize that the provision of individualized MSS in a naturalistic environment incorporating personal experience informed by participation from family members may be more effective than the use of generalized MSE interventions or reminiscence interventions alone.

In summary, current evidence suggests some positive results regarding the impact of Snoezelen on BPSD, particularly in patients with severe dementia; however, current studies are underpowered, with varying intervention protocols making comparisons difficult. Also, only one study to date has shown sustained long-term effects. In practice, Snoezelen rooms are often underused despite perceived benefits and have high staffing needs [26]. In response to the need for improved evaluation, Lopez et al. created a new measurement tool named the COMMUNI-CARE scale that evaluates the psycho-emotional well-being of dementia patients in Snoezelen environments [30].

Nature offers MSS through both active and passive experiences, with exposure to light and sensory stimulation hypothesized to be beneficial for older adults with dementia [31]. Sensory garden and horticultural interventions have been increasingly appreciated to provide therapeutic environments and programmes in dementia. Two systematic reviews have been conducted on this topic to date [31,32]. The review conducted by Whear et al. [31] examined the impact of gardens and outdoor spaces on the mental and physical

well-being of people with dementia in care homes and included 17 studies. These researchers indicated that the quantitative studies were not of high quality, but suggested that decreased levels of agitation were associated with garden use [31]. The systematic review by Gonzalez et al. [32] looked at benefits of sensory gardens and horticultural activities in dementia care, with 16 studies examined, 2 of which were RCTs. In a group of nursing home residents ($n = 20$), Connell et al. [33] found that the intervention group had a significant increase in hours of sleep and a significant change in verbal agitation, with no other changes in behaviour observed. The second RCT is a cluster randomized study ($n = 129$); Jarrot and Gigliotti [34] found significant positive differences in engagement of the horticultural-based group versus traditional activities, but no difference in affect.

In two separate studies, Goto et al. found that viewing a Japanese garden twice a week for 15 sessions over 8 weeks reduced heart rate, evoked short-term and long-term memories and improved behavioural symptoms in nursing home residents with dementia in the USA and in hospitalized dementia patients in Japan [35,36]. In a study of moderate to severe dementia patients, exposure to nature via carer-mediated exposure to a nature-rich garden was found to result in a beneficial change in patient mood [37]. Interestingly, improvements were nonlinear and associated with shorter exposure periods, with no additional improvements with exposure beyond 80–90 min [37].

Multisensory tools

The use of multisensory tools in the treatment of dementia is currently a largely unexplored and understudied area of dementia care. Considerable anecdotal evidence has been collected on the benefits of such tools, but few comprehensive studies exist. A multisensory dementia tool holds the potential to occupy less physical space, provide a high degree of personalization, require less supervision and be more cost-effective than the implementation of MSEs. Multisensory dementia tools include twiddle muffs [38], memory blankets [39], robotic pets (e.g. PARO and JustoCat) [40–44], socially assistive robots (e.g. Clara and Pearl) [45–50] and a portable autonomous multisensory intervention device [51].

Multisensory group therapy

Multisensory group therapeutic interventions are growing therapeutic approaches in the treatment of individuals with dementia, with the benefit of providing sensory stimulation, engagement and socialization in a more cost-effective and staff-efficient manner than traditional one-on-one interventions. Current MSS group therapies include Sonas, Sensory Day, multisensory group exercise, a multisensory and motor-

based group activity programme and multisensory themed boxes for group therapy.

Sonas, an Irish word meaning “well-being, joy and contentment” is a group intervention initially developed as an intervention for individuals with learning disabilities and involves MSS, reminiscence and light physical activity [52]. It has since been adapted for use in patients with dementia. Over 6200 health care staff have been trained in the Sonas programme in Ireland and the United Kingdom [52]. Observational studies and anecdotal evidence suggest that the Sonas programme can result in improvements in awareness, mood, memory and communication [53]. A randomized controlled pilot study of 39 participants with moderate to severe dementia residing in care homes found no statistically significant improvement in depression, anxiety, behavioural disturbance, communication and quality of life when comparing 14 sessions of Sonas to treatment as usual [52]. Despite this finding, the authors note that Sonas continues to be widely used in the care of dementia residents, particularly in Ireland. The lack of generalizability and high intensity of staff resources required in Sonas implementation make feasibility and consistent delivery challenging.

In a small naturalistic study ($n = 14$), increased levels of constructive engagement and positive affect were noted during participation in monthly “Sensory Day” sessions, a group-based multisensory activity programme for residents with severe dementia at an aged care facility [54]. In a group study ($n = 13$) in individuals with Alzheimer’s disease, results showed an improvement in resting heart rate, overall mood and engagement in physical activity. This study was limited by the lack of a control group and randomization [55]. Cruz et al. conducted a pilot study ($n = 4$) to develop a multisensory and motor-based group activity programme for care home residents with dementia to increase engagement in meaningful activities and improve quality of life. Sixteen 45-minute weekly sessions were delivered tailored to residents’ characteristics, and the residents’ behaviours were assessed using video recordings. This study found that even individuals with advanced dementia could effectively participate in group-based activities appropriate to their cognitive and functional levels [56]. Finally, Griffiths et al. conducted a qualitative study exploring the use of 6 multisensory themed boxes containing items designed to encourage conversation in weekly group sessions held for individuals with dementia [57]. Multisensory boxes, including those with olfactory stimulation, were found to be engaging interventions for individuals with dementia and their caregivers [51].

Conclusions

Overall, there is evidence suggesting that MSS interventions can improve mood, behaviour and quality of

life in seniors with dementia and BPSD, particularly when a personalized approach is taken. MSS interventions in the form of MSEs, tools and group therapies present tremendous potential in the realm of nonpharmacological interventions. However, despite being discussed frequently, a surprisingly limited body of quality evidence currently exists to support the use of MSS interventions in patients with dementia. Although a lack of evidence does not necessarily mean a lack of efficacy, there is a pressing need for studies with improved power and study design to determine the effectiveness of specific MSS interventions and for whom they may be beneficial. Of the MSS interventions discussed, MSS tools hold the most promise of an individualized, easy-to-implement, cost-effective intervention with minimal supervision required.

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