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Potential of Snoezelen room multisensory stimulation to improve balance in individuals with dementia: a feasibility randomized controlled trial

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Abstract

Objective: To investigate the influence of multisensory stimulations in a Snoezelen room on the balance of individuals with dementia.

Design: Randomized controlled trial.

Setting: Canadian long-term care home.

Participants: Twenty-four residents (average age 86 years), in a long-term care home diagnosed with dementia, were assigned randomly to intervention and control groups. Nineteen participants completed the study.

Interventions: Nine intervention group participants completed 30-minute Snoezelen room sessions twice a week for six weeks. Sessions were guided by participants' preferences for stimulation. Interactions with tactile, visual and proprioceptive sensations were encouraged. Ten control group participants received an equal amount of volunteer visits.

Main outcome measures: The Functional Reach Test, the eyes-open Sharpened Romberg and the Timed Up and Go Test with and without dual task, assessed static and dynamic balance at baseline and after the intervention. Falls frequencies were recorded six weeks before, during and after intervention. A journal was kept of observations in Snoezelen room.

Results: Split-plot MANOVA analyses revealed no significant effects of unstructured Snoezelen room sessions on participants' balance. There were no multivariate effects of time ($F(4,14) = 1.13$, $P = 0.38$) or group ($F(4,14) = 0.63$, $P = 0.65$). Group membership did not alter falls frequency. However, observations of participants' interactions with elements of the Snoezelen room, such as imagery-induced head and eye movements, vibrating sensations and kicking activities, captured events that can be used to create specific multisensory balance-enhancing stimulations.

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Conclusions: Although the null hypothesis was not rejected, further investigation of a potential to influence balance in individuals with dementia through Snoezelen room intervention in long-term care homes is warranted.

Keywords
Snoezelen room, balance, dementia

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Introduction

Individuals with dementia have a two to three times greater risk of falling compared to age-matched controls.[1,2] There are few empirically derived or tested falls prevention programmes available for individuals with dementia. The risk factors for falls among persons with dementia are multifactorial in nature and include both intrinsic (person-related) and extrinsic (environment-related) influences.[3] Individuals with dementia often have increased postural sway and reduced ability to balance, which can result in falls.[4] The central nervous system must process and integrate sensory information from visual, vestibular and somatosensory systems in order to regulate motor movements necessary to maintain balance.[5] Neurological impairments, seen in those with dementia, can produce declines in the central integration among visual, vestibular and somatosensory systems, putting individuals at increased risk for falls due to balance impairments.

One therapeutic approach being used increasingly in long-term care homes for both relaxation and stimulation of individuals with dementia is a Snoezelen room. Users of a Snoezelen room are exposed to effects of touch, lights and colours, sounds, smells, and tastes to stimulate and to sooth. Snoezelen is useful particularly for children or adults with developmental issues, brain injuries or autism, as well as individuals with dementia. Results reveal minor improvements in attention/concentration, mood and communication, and reduced expression of negative behaviours, although comprehensive reviews have cautioned the lack of clear evidence.[6,7] The multisensory stimulations might possess the potential to provide a safe environment for balance-enhancing activities. Vibrating objects, swinging chairs and activities designed to encourage visual tracking of movement provide proprioceptive, vestibular and visual stimulants that can optimize cue integration. It is possible that simultaneous exposure to these sensations produce unique challenges for the central nervous system to maintain balance. Snoezelen rooms may have the potential to improve sensory system integration and, subsequently, to influence balance, although no systematic study to date has examined this influence.

Currently, there are no published studies investigating the effects of Snoezelen rooms on balance among individuals with dementia. Westlake et al. examined whether sensory specific balance training, eye tracking activities, head movement drills and surface balance activities improved the balance of healthy older adults.[8] They found a significant effect on one of three outcome measures: a participant's ability to detect body motion or velocity discrimination. However, this type of training programme did not capture fully the variety of cues or the unique simultaneous multistimulant environment of the Snoezelen room.

The rationale for the use of Snoezelen rooms is based on providing a safe, sensory environment that places few demands on complex cognitive abilities but capitalizes on remaining sensorimotor capacities of people with dementia.[6] The purpose of this study was to investigate the influence of multisensory stimulations in the Snoezelen room on balance and falls among individuals with dementia residing in a long-term care home.

Method

This randomized controlled two-group study consisted of a six-week pre-intervention period, a six-week intervention period, and a six-week post-intervention period. Research was conducted at an urban, not-for-profit long-term care home located in Ontario, Canada. With over 390 residents, staff in the long-term care home provide comprehensive care to residents who collectively have an average age of 86 years. The local University Health Sciences Research Ethics Board and the administrative officers of the facility approved the study. All participants were informed about the study details and, if assent was given, explicit written consent for participation was obtained from participants' substitute decision makers.

Residents with cognitive deficits, evaluated by scores of less than 25 out of a maximum of 30[9] on the Standardized Mini-Mental State Exam,[10] who understood simple walking instructions, who were able to walk with minimal assistance, and who had not attended a Snoezelen room in the three months prior to this study were recruited. Exclusion criteria included: a history of seizures, legal blindness, profound hearing loss, history of limb fractures, and extrapyramidal system disruptions manifested by the inability to remain motionless or to initiate movement.

A total of 24 eligible residents were recruited. Prior to the commencement of the study a computer-based random number generator was used to randomly select 12 numbers out of 24. These numbers were assigned to the intervention group. The remaining 12 numbers were allotted to participants in the control group. As multiple recruitment packages were sent out simultaneously, and the participants were assigned a number in chronological order when a signed consent document was received, recruitment order and group allocation were unpredictable.

Participants in the intervention group completed individual 30-minute sessions of stimulation and relaxation in the Snoezelen room twice a week for six weeks, with at least two days separating the two weekly sessions. Continuity of diurnal scheduling was attempted; however, sessions were not always delivered at the same time of day. Sessions were structured around each participant's preferences; however, activities that stimulated tactile, visual and proprioceptive sensations were encouraged by the facilitator (KK). These activities included: wearing and touching vibratory shoes and pillows, swinging in a hanging hammock, throwing or kicking differently shaped balls, and eye-tracking and head-moving activities using image projectors, bubble machines and water panels. Other multisensory activities in the room included listening to background music, smelling scents from an aroma diffuser and playing percussion musical instruments such as a drum or tambourine. To document qualitatively balance-related activities or behaviours, the facilitator kept a detailed journal of each session, recording activities that potentially had balance-enhancing effects (e.g. challenging body postures, single-leg standing or vibration stimulation of feet). Both positive and negative reactions to elements of the room were recorded, such as agitation or emotional responses to cues. The facilitator and participants developed a trusting relationship to ensure that each participant felt safe and secure during interactions with the Snoezelen elements in the room.

Participants in the control group received one-on-one visits by a volunteer to account for the intervention groups' individual interactions with the facilitator in the Snoezelen room. Elders and volunteers engaged in activities that were of interest to the control group participants, such as listening to readings of the newspaper, looking at magazines, playing cards or a board game, and talking. These activities took place in the resident's room or the hallway adjacent to her or his room. In four cases participants preferred to receive visits in the lounge area. This was permitted as long as volunteers censored the possibility of multiple simultaneous sensations.

Four tests used to determine pre- and post-intervention balance included the Functional Reach Test,[11] the Sharpened Romberg,[12] and the Timed Up and Go Test with[13] and without[14] a cognitive dual task. The Sharpened Romberg only included an eyes-open trial with participants standing in a tandem stance for a maximum of 30 seconds. The Timed Up and Go Test with cognitive dual task protocol of counting backwards by threes from a random number between 20 and 100[14] was altered to counting up by ones with best capability, to ensure the cognitive challenge was manageable for study participants with advanced stages of cognitive impairment. In the current study, the random number was pre-set between 20 and 100 in advance by the research team. The Functional Reach Test and Sharpened Romberg are tests of static balance whereas the Timed Up and Go Tests with and without a cognitive dual task are tests of dynamic balance. Other more frequently used balance tests, such as the Berg Balance Scale,[15] were omitted due to the complexity of test instruction, test length and general lack of suitability for participants with dementia. For each of the four tests, two trials were conducted, and the average time or length were calculated and analysed. All assessments were performed between 1 and 5 pm.

Secondary outcome measures included frequency of falls recorded in the pre-, during and post-intervention periods. Nursing staff at the facility used the 'progress notes' section of resident charts to keep a chronological and detailed record of falls that included description of the event and details about injury. An investigator reviewed all charts and extracted adverse events for each of the three six-week periods of the study. The investigator administering assessment tests and recording primary and secondary outcome measures was not blind to group allocation.

A split-plot MANOVA was conducted to examine differences between groups (intervention vs. control group) in pre- and post-intervention periods for the four balance tests. Within-group (pre-intervention vs. post-intervention) changes over time also were analysed using a split-plot analysis. Frequency of falls before, during and after intervention were analysed using simple t-tests. Bonferroni corrections were applied to secondary analyses to correct for multiple comparisons. The P-value was set at 0.05 with corrections yielding $0.05/3 = 0.017$. It is acknowledged that this sample size limits inferences due to low power.

Results

During the intervention period, two participants from the intervention group withdrew because of a lack of interest in the Snoezelen room. Two participants in the control group and another one in the intervention group were excluded from the analysis because of incomplete data. The incomplete data set for these three participants resulted from their refusal to attempt a test and an inability to comprehend instructions for one or more of the tests. Split-plot analyses of the final data set included measurements from 9 intervention and 10 control group participants (Figure 1).

Although the intervention group was significantly younger, with an average age of 84 (SD 6.6) years compared to 89 (SD 3.2) years in the control group ($P = 0.01$), the two groups had comparable average standardized Mini-Mental State Examination scores (Table 1). The split-plot MANOVA analysis revealed no significant effects of the Snoezelen room intervention on the balance of residents with dementia. The multivariate effect of time was negative from pre- vs. post-intervention ($F(4,14) = 1.13$, $P = 0.38$). The multivariate effect of group also was negative pre- vs. post-intervention ($F(4,14) = 0.63$, $P = 0.65$). Because time and group main effects were not significant, it was not surprising that the multivariate interaction effect of time by

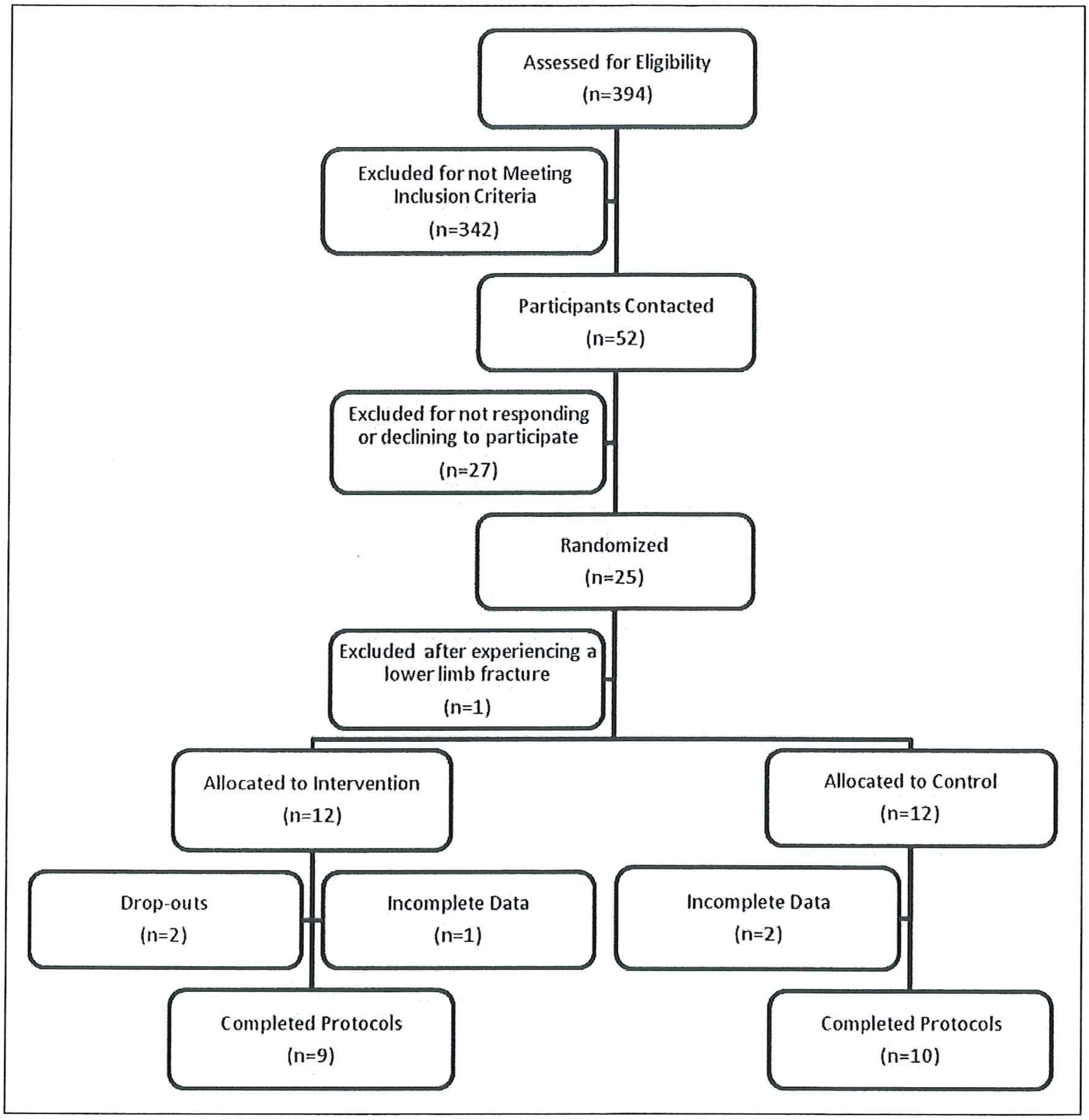

Figure 1. Participant flow in the study.

group also was not statistically significant ($F(4,14)=0.92$, $P=0.48$). Both intervention and control groups showed trends toward small balance improvements over time on all tests, although none were statistically significant (Table 2).

Secondary outcome analysis included results from all 24 participants who started the study. Over 18 weeks of the study period, there were 16 falls in the intervention group and 44 falls in the control group. One participant in the control group was an outlier, responsible for 21 of

44 falls in this group. Results for this individual were atypical, so these data were removed from further analysis. Before, during and after intervention there were 5, 7 and 4 falls in the intervention group and 8, 8 and 7 falls in the control group, respectively. Frequency of falls in the intervention group did not change significantly over the course of the intervention ($t(11) = -0.167$, $P = 0.504$) or after the intervention ($t(11) = 0.083$, $P = 0.586$). Similarly, frequency of falls between intervention and control groups was not significantly different in pre- ($t(23) = 1.09$, $P = 0.29$), during ($t(23) = 1.23$, $P = 0.47$) and post-intervention ($t(23) = 0.74$, $P = 0.47$) periods.

Despite negative statistical findings, journal-recorded observations of participants' activities in the Snoezelen room suggest that certain activities have the potential to improve balance. Fibreoptic visual objects and pictures projected on the wall of the Snoezelen room were the visual stimuli. All participants were recorded as moving their heads and following the imagery with their eyes. This occurred to varying degrees in many sessions, with engagement levels depending on which room elements were used. For instance, the image projector cued a great deal of head movement, whereas bubble tubes mainly caused eye movements. Although all participants were exposed to vibrating sensations, six actively sought out or expressed enjoyment when exposed to massages from vibrating pillows. Two participants enjoyed this stimulation during every session for the entire length of the session, and other four enjoyed vibration sensation in over 6/12 sessions, for varying amounts of time. Two of these six participants also enjoyed vibrating shoes, in 4/12 sessions for up to 5 minutes each time.

Three participants engaged in kicking a giant beach ball back and forth with the facilitator in 6/12 sessions for an estimated 4 minutes. When standing, this activity required balancing on one foot and lining up their swinging leg to make contact with the ball. The challenge of kicking the ball increased in the darkened environment of the Snoezelen room. For this activity, after 1 minute of standing and kicking, participants would sit down and continue to kick the ball. Two participants repeatedly chose to sit and

Table 1. Participant demographic information

	Intervention group ($n = 9$)		Control group ($n = 10$)	
Variable	Mean	SD	Mean	SD
Women	7		6	
Use of mobility aid	4		5	
Age	84	6.6	89	3.2
Height (cm)	162	7.3	167	12.6
Weight (kg)	62	8.8	66	22.5
SMMSE	12 [4–22]	7.4	13[2–22]	6.4

SMMSE, Standardized Mini-Mental State Examination.

Table 2. Mean scores and standard deviations for tests pre- and post-intervention period

	Intervention group				Control group			
	Pre-		Post-		Pre-		Post-	
Test	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FRT (cm)	11.3	5.8	11.8	3.8	10.3	8.8	11.9	5.8
SR (seconds)	21.5	7.0	23.7	10.6	24.7	6.8	29.4	1.9
TUG (seconds)	34.9	22.6	31.9	8.4	32.2	20.0	28.4	11.3
TUGc (seconds)	43.9	22.5	36.2	9.7	36.1	21.0	35.1	18.0

FRT, Functional Reach Test; SR, Sharpened Romberg; TUG, Timed Up and Go; TUGc, Timed Up and Go with dual task.

swing in a hammock hanging from the ceiling. One participant spent 8/12 sessions and the other spent 4/12 sessions exclusively in this activity. Interestingly, while resting in a hammock, without her glasses and with limited visual cues, one participant could not feel the swinging motion until the facilitator substantially increased the magnitude, within safety limits, of force applied to the hammock. Other activities enjoyed by participants included playing musical instruments, smelling a variety of scents provided by the aroma diffuser, and touching tactile objects such as fibreoptics, stress balls and soft blankets.

Discussion

Results from the four static and dynamic balance tests used in this study suggest that unstructured Snoezelen room sessions provided to individuals with dementia on a one-to-one basis for six weeks have no significant effects on enhancing balance or reducing falls. There were no significant changes in balance test scores and falls rates frequency within groups over time, or between the intervention versus the control group. This conclusion should be interpreted with caution within the context of low statistical power due to the limited number of participants in this study as well as to the study's exploratory nature.

Observations of participants' activities during Snoezelen room sessions suggested a potential for the creation of structured programmes that might impact balance of individuals with dementia. Many activities in the Snoezelen room promote head and eye movement, which can have a positive effect on balance.[8,16] Vibration, which triggers proprioception cueing effects through stretching of muscle spindles, is provided in the Snoezelen room through vibrating shoes and pillows. The literature shows that proprioceptive stimulation through vibration can affect postural orientation even when vibration is terminated.[17] Whole-body vibration can have positive effects on the balance and mobility of individuals with Parkinson's disease after a three-week intervention programme and at a four-week follow-up. However, this vibration was usually delivered while participants were standing on a platform.[18] One-leg stance or narrowed support base exercises also have been shown to increase balance.[19] Kicking the giant beach ball back and forth forced one-leg stance situations. This was a challenging exercise for the participant yet the room provided a safe and encouraging environment in which to practise these skills.

Another potential balance-enhancing activity in the room was swinging in the hanging hammock, which could provide cueing of vestibular receptors in the inner ear that provide information to the central nervous system about head position and movement.[5] This stimulation is similar to rocking-chair therapy, which also holds vestibular cueing potential for those with dementia.[20]

The current study design permitted each participant to have unique experiences in the Snoezelen room with different levels of interaction with multisensory stimulations, depending on participants' interests, mood and functional levels. It is possible that these stimuli were too unstructured and too few to have a significant effect on proprioception, the vestibular system, vision and/or balance. However, the study's aim was to determine whether the multisensory stimulation had any effect on balance when Snoezelen room stimulations were used in the way the room was designed and intended, without structured exercise programming or training. Two observational studies with a small number of participants that investigated the physical implications of the room produced results showing reduction of unnecessary body movements[21] and increased active looking and attentiveness.[22]

The ability to improve the balance of individuals with dementia is limited due to already compromised somatosensory systems and central nervous system deteriorations. Rare, empirically derived prevention programmes are available for individuals with dementia with limited evidence that the risk for falls can be modified among these individuals.[3] Some evidence shows that physical training and targeted strength, stamina, suppleness, coordination and cognitive activation have positive effects on falls prevention and balance in individuals with dementia.[23,24] However, these trials were small-scale studies and the effectiveness of falls prevention in individuals with dementia has yet to be determined.[25]

Encouraging mobility and exposure to risky situations in less physically able individuals through balance interventions can be counter-productive to falls reduction.[26] Turning the focus from a physical activity intervention, some researchers in the area believe that an intervention specifically targeting executive function or attention would decrease falls in this population because intact executive function is required for normal motor control.[27] In the current study, it is possible that the Snoezelen intervention improved attention and concentration in participants leading to the small balance improvement trends. Despite the negative statistical findings, the link between sensory-specific activities and balance warrants further investigation due to the positive observations noted. Sensory environments of the Snoezelen room offer a resourceful venue in which to explore balance-enhancing potential in greater depth and detail.

The exploratory nature of this study and the small number of participants limit the generalization of findings. Validity and reliability of selected outcome measures have not been comprehensively studied in the context of testing individuals with dementia. It is possible that performances on the tests were influenced by variable disease pathologies, fluctuating levels of attention, multiple medications, diverse medical and psychiatric comorbidities, and motor impairments, among other factors. There is potential for measurement bias because the investigator was not blinded to study group allocation. Although recommended by the scientific literature,[6] the six-week period may have been too short to allow adequate engagement of participants with balance-enhancing stimulants of the room.

Examining the utility of Snoezelen room to enhance balance is difficult due to inconsistencies in which Snoezelen elements were used by participants, variability of the room elements, and facilitator and participant values.[6] We specifically targeted a wide range of Snoezelen element options that were implemented based on participants' interests and preferences. We believe that such individualization of approaches is a strength, even in light of methodological weakness considerations. Establishing Snoezelen as a beneficial therapeutic intervention is complicated by heterogeneous research designs, weak methodologies and small number of completed studies, which make meta-analyses difficult.[7] Nevertheless, these limitations need to be interpreted in light of substantial challenges encountered when conducting research with older, cognitively impaired residents in long-term care institutions.

Recommendations for future research

Based on lessons learned in this project, there are several recommendations for future studies. Other outcome measures should be explored, such as body velocity discrimination, passive joint positioning sensation, body sway, head velocity or the Berg Balance Scale. Comorbidities, acute health issues, medications, fatigue, muscle strength and endurance, familiarity with the task and management of pain also should be recorded and reported because they can represent major confounders in the accurate measurement of balance and of the frequency of falls. It is recommended for future studies that the causes of falling be recorded to determine whether falls occurred due to balance impairments or to other factors such as incontinence, environmental hazards or poorly designed or used assistive devices. Knowledge of the severity of dementia can be helpful in adjusting to fluctuating levels of awareness, attention and memory capacity that cause interferences in completing activities in the Snoezelen room. When the participant shows interest, hands-on activities can keep these individuals engaged and connected with the stimulants.

Clinical messages

- Six weeks of unstructured, biweekly, 30-minute Snoezelen room sessions did not positively influence balance in individuals with dementia residing in a long-term care home.
- Observations of participant interactions with elements of the Snoezelen room suggest that the room potentially could provide specific and structured balance-enhancing activities to long-term care residents.

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