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Does Spaced Retrieval Therapy Help Improve Quality of Life for Individuals with Dementia?

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ABSTRACT

Objective: The objective of this systematic EBM review is to determine "Does Spaced Retrieval Therapy Help Improve Quality of Life for Individuals with Dementia?"

Study Design: A systemic review of three peer-reviewed randomized controlled trials (RCT) published in English between 2016-2017.

Data Sources: All peer-reviewed articles were selected using PubMed. All articles were published in English and selected based on relevance to the clinical question. Exclusion criteria excluded studies with combined intervention methods.

Outcome Measured: Assessment of instrumental activities of daily living (IADL) was determined using the IADL task score assessed by the recruiter. Improvement of hyperphagic behavior assessed by trained memory trainers determined by the Dementia Hyperphagic Behavior Scale.

Results: All studies determined the efficacy of spaced retrieval therapy and its role in improving the quality of life of the participants with dementia. The RCT of Bourgeois et al. found that spaced retrieval therapy and trial and error learning (control) produced no significant difference, determining both learning methods capable of improving patient outcomes. The results of Kao et al. revealed that spaced retrieval therapy significantly improved hyperphagic behaviors lasting three months after completion of the program when compared to routine care (control). The Hsu et al. study determined that spaced retrieval therapy can decrease the severity of hyperphagic behaviors compared to routine care (control).

Conclusion: All studies report spaced retrieval therapy is an acceptable tool capable to improve the quality of life for individuals living with dementia. These studies suggest behavioral and speech therapy (spaced retrieval) is effective enough to improve hyperphagic behavior and IADL. Future studies should be conducted to determine the longevity of new learned behaviors/activities as well as the minimum intervention period required for long-lasting benefit.

Key Words: Spaced retrieval therapy, dementia

INTRODUCTION

Dementia is characterized by a cognitive decline in various areas of learning, memory, executive function, attention, and perceptual-motor skills compared to the previous functioning of the individual. Commonly seen in advanced ages, cognitive decline is severe enough to interfere with independence and daily functioning and is not a normal consequence of aging. Dementia is an umbrella term broken into subcategories based on clinical presentation and diagnostic criteria. The most common form of dementia is Alzheimer's disease representing 60-80% of cases. Other forms include vascular dementia, Lewy body, frontotemporal dementia, and Parkinson's disease dementia.[1] The most notable manifestation of dementia presents with progressive memory loss and a progressive loss of the ability to perform activities of daily living. The insidious nature of the disease can result in increased loss of an individual's independence, increased dependency on family members and caregivers, or in severe cases institutionalization in long-term care facilities. Examples of loss of function include the inability to bathe, dress, cook, and even proper feeding as inappropriate swallowing can manifest from this diagnosis. The functional decline can result in adverse outcomes such as increased rates of hospitalization, secondary diagnoses, or even death.[2]

A projected 50 million people worldwide were diagnosed with dementia in 2015; this number is predicted to rise to 82 million by 2030.[3] The United States is likely to follow this trend as the aging baby boomer population is living to later decades of life due to increased life expectancy modern medicine has afforded those with comorbidities. An estimated 6.2 million people in the United States live with Alzheimer's dementia as of 2021.[3] Physician assistants in a primary care setting are likely to be the first to document cognitive changes of patients with the

help of reporters such as concerned family members. Dementia does not only affect the individual diagnosed with the disease but also the family members and caregivers.

The healthcare expenditure related to dementia consists of hospital and patient care costs. Hospitalizations lead to inpatient care, outpatient follow-ups, and monitoring; mediations, diagnostic exams, nursing/caregiver assistance, and travel expenses all play a role in the cost of comprehensive care. Dementia is associated with increased emergency room visits due to falls and increased office visits to address referral requests, documentation of official caretaker requirements, creation of care plans, monitoring and revisiting programs for patients and caregivers. With the growing number of individuals living with dementia, costs related to loss of productivity due to disability, not only impact the patient but the social support as well.[4] The estimated annual societal cost of $41,000-$56,000 per case for dementia patients in 2010.[5] The nationwide expenditure of dementia-related expenses were estimated at $818 billion in 2015, an increase of 35% from 2010. The majority of the costs were related to social and familial support rather than specific medical costs.[5]

Dementia can often be confused with mild cognitive impairment, a normal physiological process of aging. Principal signs of dementia include becoming lost in familiar places, forgetting the names of close friends or family, or inability to complete tasks independently. Risk factors include age >65, family history, poor health, and brain injury. In many cases, the causes of dementia are unknown such as the underlying mechanism of plaque and tangle build-up, or why specific protein build-up causes changes that result in various subcategories of dementia.[1] A commonly prescribed medication, cholinesterase inhibitors, is effective in memory, thought, and judgment enhancement. These medications prolong the neurotransmitter acetylcholine and prevent its breakdown. Other pharmaceuticals such as memantine, a neuroprotective agent,

regulate glutamate levels which play a role in learning and memory. The diagnosis of dementia often leads to secondary diagnoses which require medical treatment for depression, insomnia, hallucinations, and agitation.

Spaced retrieval therapy is an intervention that aims to increase learning and retention of target information as well as recalling information over increased time intervals. This strategy also develops semantic memory and behavioral tools in individuals with mild cognitive impairment as well as dementia.[6] Spaced retrieval therapies utilize assisted practices of high repetition with limited variation to facilitate motor or procedural learning with the goal of accurate recall. Space retrieval works by showing the patient a visual aid, in a step-by-step fashion, of a specific task they are to perform. First, each task is modeled to the participant and then asked to perform it step-by-step. If performed correctly, they will advance to the next step with a period of pause or distraction. The patient will then repeat the previous step, and if successfully recalled, can proceed to the next. If unable to evoke the previous action, the participant must restart the sequence and relearn all steps in order. This pattern will continue until the task is complete, using increasing intervals of distraction or pause as the participant progresses.[7] Individuals with dementia can utilize spaced retrieval to enhance familiarity with their surroundings and memory through repetitive behaviors to improve independence.

OBJECTIVE

The objective of this systematic EBM review is to determine “Does Spaced Retrieval Therapy Help Improve Quality of Life for Individuals with Dementia?”

METHODS

This systematic review used resources and peer-reviewed articles selected by the author of this paper based on relevance to the clinical question: Does spaced retrieval therapy help improve the quality of life of individuals with dementia? The articles chosen assessed if the intervention of spaced retrieval therapy can improve patient outcomes. Utilization of PubMed literary search engine to select the three peer-reviewed articles in this systematic review with the keywords 'spaced retrieval' and 'dementia.' Special consideration to make sure all articles were randomized control trials and the exclusion requirement of combined intervention methods e.g., spaced retrieval combined with errorless learning. Inclusion criteria included articles published from 2010-present, English language, and clinical trials.

Table 1 represents the demographics of participants in each of the studies. The minimum participant requirement of all the articles was a diagnosis of dementia. The age of the participants ranged from 73-93 years old, male or female; an average of 96 patients participated across three studies. Hyperphagic-focused studies of Kao et al. and Hsu et al. compared the intervention group to a control group of routine care patients receive at their respective care facilities. Participants in the Bourgeois et al. study assessed three different learning methods, this systematic review focused on spaced retrieval therapy (intervention group) compared to trial-and-error learning (control group).

OUTCOME MEASURED

The Bourgeois et al. study utilized the instrumental activities of daily living (IADL) task score. This system assessed each step of a task sequence and allocated a score of 1-3; the total task score was adjected on a 100-point scale to be comparable to the other tasks. A score of three

Table 1. Demographics and Characteristics of Included Studies

Study	Type	# Recruited	# Participated	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Bourgeois[8] (2016)	RCT	74	52	76-93	Diagnosis of mild to moderately severe AD. Fulfil DSM-IV-TR criteria. Age 60+. Unable to complete tasks without prompting cues.	Severe deficits in alertness. Schizophrenia or depressive disorder by DSM-IV criteria. Agitation, disinhibition, irritability behaviors. Medications that can interfere with outcome (antipsychotics).	22	Spaced retrieval therapy vs. Trial-and-error therapy (control)
Hsu CN[6] (2017)	RCT	97	95	73-89	Dementia patients in resident care. Literate and communicate in Mandarin or Taiwanese. Scored ≥ 3 on Dementia Hyperphagic Behavior Scale. Cleared SRT screening.	Patients with vascular dementia. Patients with brain trauma. Patients fed through NG tube. Patient who are fed by others. Patients with an infectious disease or acute gastrointestinal infection.	2	Spaced retrieval therapy vs. Routine care (control)
Kao CC[9] (2016)	RCT	148	140	75-89	Diagnosis of dementia. Hyperphagic behavior scored ≥ 3 on Dementia Hyperphagic Behavior Scale. Cleared SRT screening. Ability to see, listen, and read. Possess fine hand movement and muscle power.	Patients with feeding tube or require assistance with feeding. BMI <18.5 kg/m^2. Vascular dementia. Recent brain injury or acute gastrointestinal infection.	8	Spaced retrieval therapy vs. Routine care (control)

deemed that specific step as "competent," meaning the participant successfully performed that step. Participants who correctly accomplished a step but either hesitated, requested external queuing, or were initially ineffective and required repetition of the previous step as priming were assigned a score of two. A step is performed incorrectly, or if the participant takes no action, a score of one is assigned and deemed a "deficit."[8]

The hyperphagic studies of Kao et al. and Hsu et al. utilized the Dementia Hyperphagic Behavior Scale created at the National Yang-Ming University in 2010. Hyperphagic behaviors were observed continuously in patients for one week, a minimum of 10 meals (six lunch or dinner meals and four snacks). Participants who did not show hyperphagic behaviors were awarded zero points. Participants observed having 1-3 instances of hyperphagic behaviors were awarded one point, 4-6 hyperphagic behaviors two points, and seven or more occurrences were awarded three points.[6]

RESULTS

The three studies selected in this systematic review focused on how spaced retrieval therapy can improve the quality of life in patients living with dementia. Bourgeois et al. conducted a randomized control study that recruited individuals with dementia diagnoses aged 76-93 (see table 1). Of the 74 recruited participants, 22 were ineligible to participate, resulting in 54 qualified individuals. The intervention group of spaced retrieval is compared to the active control group of trial-and-error learning, a known effective therapy for modulating dementia. Baseline performance was established in all participants and then trained individually in two-hour sessions twice a week for a six-week duration (see table 2). The results of this study showed significant improvement in the performance of both groups, $F(2,94)=56.86$, $p<.001$. Participants in the spaced retrieval intervention group improved by 36.62% when comparing pre and post-assessments. Trial-and

error control group improved by 40.98% when comparing pre and post-assessments. To determine the superior learning method, an F(2, 47)=.77, p-value=0.478 was calculated, resulting in no significant difference between the two groups. It was determined that spaced retrieval therapy is just as effective as trial-and-error learning, an effective treatment for individuals with dementia.[8]

Table 2. Implicit Knowledge of IADL from Baseline

Intervention	Pre-assessment	Post-assessment	Change
Spaced Retrieval	19.71%	56.33%	36.62%
Trial-and-Error	23.04%	64.02%	40.98%
Interpretation	p-value=0.478		

Bourgeois et al.

The randomized control trial of Hsu et al. and Kao et al. focused on spaced retrieval therapy to improve hyperphagic behavior (see table 1). In the Hsu et al. study, 49 participants were randomly assigned to the intervention group, while 46 participants were assigned to the control group of routine care. The researchers dismissed two participants due to hospitalization and the inability to complete 80% of the training sessions. Participants trained for a total of six weeks and completed 24 sessions. A significant difference between the two groups is observed when comparing pre and post-test results based on the Dementia Hyperphagic Behavior Scale score. The average pre-test score of the spaced retrieval group was 5.32, which improved to an average of 4.44 on the post-test, a change of -0.88 resulting in a p-value of 0.017, a significant difference in change from baseline. In contrast, the routine care group averaged a pre-test score of 5.17 and worsened to 6.21, a change of 1.04 (see table 3). A resulting p-value=0.000 determined the use of spaced retrieval therapy was effective in improving hyperphagic behavior in the participants with dementia.[6]

Table 3. Dementia Hyperphagic Behavior Scale Score

Intervention	Pre-assessment	Post-assessment	Change	p-value
Spaced Retrieval	5.32	4.44	-0.88	0.017
Routine (control)	5.17	6.21	1.04	0.001
Interpretation	p-value=0.000			

Hsu et al.

Lastly, in the randomized control trial conducted by Kao et al. a total of 140 participants were randomly assigned; 46 participants participated in the spaced retrieval (SR) intervention, and 45 were assigned to the control group of routine care (see table 1). The remaining participants participated in a second intervention group not highlighted in this systematic review. The intervention group trained for six weeks for 30 sessions total, and at the end of the intervention period, hyperphagic behavior was reassessed. When comparing SR therapy to the control group, a pre-test β-score of 0.316 and a post-test score of -2.088 was determined, with a change of 2.404 and a resulting p-value=0.000. The intervention of spaced retrieval therapy improved the hyperphagic behavior of the participants. This study assessed participants' hyperphagic behaviors 1-, 3-, and 6-months post-intervention end date. Participants showed a steady decline in their progress, with β-score of -1.963, -1.782, and -1.377 respectively, although an improvement over routine care is still recognized.[9]

Table 4. Follow-up Data Based on Dementia Hyperphagic Behavior Score in β-score

Intervention	Pre-assessment	Post-assessment	Change	p-value
SR vs. RC	0.316	-2.088	2.404	0.000

Kao et al.

DISCUSSION

The three randomized control trials discussed in this systematic review determined use of spaced retrieval therapy can improve the behavior of individuals with dementia. The Bourgeois et al. study determined training methods can assist in successful relearning of IADL tasks in cases of mild-to-moderately severe Alzheimer's dementia. All participants, regardless of their intervention group, improved their performance indicating modeling with spaced retrieval is just as effective as trial-and-error learning. Improvement of relearning IADL was able to be sustained one month after the completion of the program intervention. The results of this study confirmed that it is possible to obtain consistent improvement in IADL performance in individuals living with dementia even with a short intervention interval of six weeks.[8] Several limitations exist within this study. First, the limited sample size of 54 participants is not a large enough sample to make overarching generalizations about the entire population, although the results from this study are promising. Additionally, each participant was given a set of tasks specific to their needs and varied between participants. The number of tasks assigned to participants remained consistent, although the number of steps to complete a task can vary based on task difficulty. These variations increase variables within the study and could have affected the validity of the study results. Calculation of percentage score is the method utilized by the researchers to equalize these variables.[8]

Hsu et al. used spaced retrieval training program to target the improvement of appropriate eating behavior (ability to chew slowly, swallow after thoroughly chewing, ability to eat at a normal speed) and stop eating cues to improve hyperphagic behavior in the participants living with dementia. Utilizing repetition priming and procedural memory in the spaced retrieval therapy aided participants to learn and retain behaviors which helped decrease instances of hyperphagic behavior. Appropriate eating behaviors and the ability to stop eating are all achievable by the use

of step-by-step training programs like spaced retrieval therapy.[6] The chief limitations addressed by the researchers in this study included the demographics in which the male-to-female ratio was around 2.5:1; this could influence overall generalization. Researchers also acknowledged the six-week intervention period may not be sufficient enough to infer the long-term benefit of spaced retrieval therapy in the dementia population.[6]

The study of Kao et al. determined that spaced retrieval therapy training can significantly improve hyperphagic behaviors in an individual with dementia without the need for incentive. Spaced retrieval therapy targeted the behaviors of rapid eating, increased eating, and overall pica (overall patient outcome) of eating inedible or inappropriate food. This study determined the deconstruction of tasks into small components during learning is an effective method for improving hyperphagic behavior. The limitations of this study are focused on the population demographics. Participants recruited in this study were selected from dementia care units in Taiwan, thus the study results may only be generalized to Taiwanese residents residing in dementia units. This study focused on observed behaviors and improvement rather than psychological or psychological gains spaced retrieval therapy may have on an individual. Further studies can access a wide range of impacts that can be beneficial to the overall intervention and its benefits.[9]

Limitations are acknowledged within this systematic review. First, this review highlighted the research findings of just three studies. A review of more randomized control trials can aid in the validity. The two studies of Hsu et al. and Kao et al. used Taiwanese participants from dementia care units, and as mentioned by Kao et al., results may only be generalized to the Taiwanese population and not the United States. Lately, the average sample size of 96 across all three studies is not large enough to make generalized statements across other cultures and ethnic groups. QoL is an encompassing topic consisting of elements not discussed in this systematic review. Future

studies that focus on other aspects of QoL such as the impact of comorbidities, compliance with interventions, participant satisfaction, and familial impact are all important aspects to consider when using spaced retrieval therapy to improve QoL in individuals with dementia.

CONCLUSION

This systematic review evaluated the question, does spaced retrieval therapy help improve the quality of life of individuals with dementia? The studies of Bourgeois et al., Hsu et al., and Kao et al. all determined that spaced retrieval therapy is beneficial to improving quality of life, whether it be the improvement of hyperphagic behavior or gaining independence when performing IADL. Through repetitive behavior, patients can improve procedural learning and in turn improve safe swallowing practices to prevent aspiration or increase independence by sustaining daily practices of well-being. All studies conducted a six-week intervention period, and some followed participants' progress months after completion. Future studies can investigate the optimal intervention period needed to sustain long-lasting results and determine how often interventions would need repeating. A diversified sample group within the USA inclusive of various ethnicity and socioeconomic statuses would provide a better understanding of spaced retrieval's impact on citizens of the United States.

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