Critical Review:
In people with dementia, does giving direct intervention help to decrease anomia, and are gains maintained over time?

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This critical review examines the evidence for the effects and maintenance of direct treatment of anomia in dementia. A search through electronic databases resulted in eight articles meeting the selection criteria, four single-subject designs and four case control studies. Overall, the research indicates that anomia therapy can be effective in people with dementia, and that effects can be maintained over time. Factors of therapy included type of stimuli and learning methods.

Introduction

Dementia is a progressive syndrome in which memory, cognition, behaviour, and even language are affected. An estimated 50 million people around the world have some form of dementia (World Health Organization, 2017). Two types commonly described in the speech and language literature include semantic dementia (SD) and Alzheimer's disease (AD).

SD is the fluent form of primary progressive aphasia (PPA). PPA is a progressive neurocognitive disorder, characterized by an insidious onset and deterioration of language skills (Jokel & Anderson, 2012). SD is characterized by loss of semantic content and is marked by atrophy of the anterior temporal lobe, typically worse in the left hemisphere (Bier et al., 2009; Heredia, Sage, Lambon Ralph, & Berthier, 2009; Hung et al., 2017; Jokel & Anderson, 2012). Symptoms include fluent language output with impaired naming, single word comprehension, face and object recognition decay (Bier et al., 2009; Jokel & Anderson, 2012; Jokel, Rochon & Leonard, 2006).

AD is a well-known type of dementia. While a neurological cause of naming deficits in AD is not fully understood, there has been evidence that naming deficit severity is predicted by higher plaque burden and more volumetric loss in the anterior and lateral temporal lobes (Hung et al., 2017). AD symptoms can vary widely, but language is a common area of impairment (Flanagan, Copland, van Hees, Byrne, & Angwin, 2016).

Anomia, or word-finding problems, is common in both AD and SD is anomia (Flanagan et al., 2016; Hung et al., 2017; Morelli, Altmann, Kendall, Fischler & Heilman, 2011). Anomia can have a significant impact on daily living and the general well-being of individuals with dementia (Savage, Piguet & Hodges, 2014). There are relatively few studies that investigate direct intervention for anomia in dementia, and even fewer that investigate the maintenance of any reported gains. The importance of maintenance findings in these disorders is a key for therapy. If evidence can be found that therapeutic gains can be maintained, that could mean longer preservation of trained skills and an increase in quality of life.

Some of the therapies in the following review investigate effects of simple study in order to learn words, but others add extra factors to their treatments to investigate what might maximize efficacy. Some studies focus on evaluating learning methods (e.g., spaced retrieval, in which time intervals between information recall increases), other studies focus on what stimuli factors will achieve the best results (e.g., personal relevance).

Objectives

The primary objective of this poster is to critically review the current state of the research regarding the effects and maintenance of direct intervention for anomia in individuals with dementia.

Methods

Search Strategy
Various online search engines, including: PubMed and PsycINFO, were used to locate articles. The following search terms were used: "dementia" or "Alzheimer's" AND "language therapy" or "anomia therapy" or

"language intervention". Relevant articles were also found using the reference lists in previously obtained articles.

Selection Criteria

Articles were accepted into this review using the following criteria: participants had a label of dementia, treatment focused on the symptom of anomia, and long-term effects of treatment were tracked. The eight final studies accepted into this review include studies that examine anomia therapies for AD and SD.

Data Collection

Studies included in this review included single-subject design studies (4) and case control studies (4).

Results

Single-Subject Design

Single subject designs manipulate one or more variables while using the participants as their own controls within a study. This design is commonly found in the area of anomia treatment in dementia, as dementia is a relatively rare disease and the field is still quite young. The generalizability is weak, but the information provided can be very valuable and help direct future research.

Jokel, Rochon and Leonard (2006) explored whether emphasis on personal relevance and familiarity would affect learning and retention of words in a 63-year old female with SD. She independently studied target words for a half-hour per day over three weeks, tracking her practice on a tracking sheet. Each week involved a different condition based on her ability to name (N) and comprehend (C) the word (as measured at baseline): +N +C, -N +C, and -N -C. Personal relevance was integrated by allowing her to select the words, and to provide her own description of them. Outcome measures included item naming immediately post-intervention, and at one- and six-months post-intervention. Additional language measures were taken at baseline to describe abilities. Results showed a significant treatment effect in naming of -N +C and -N -C words. The -N +C condition showed a significant effect of treatment at one-month post-intervention, and no conditions reached significance at six-months post-intervention. Items in the +N +C condition never showed significant differences between baseline and six months post-intervention but control items in that condition did.

Strengths of this study include well-described procedures, appropriate stimuli selection with implementation of personally relevant materials, and appropriate statistical analysis. There are several weaknesses. These include lack of non-personally relevant control stimuli, and lack of control inherent in a self-driven therapy.

Overall, this study provides suggestive evidence of the value of personal relevance and prior knowledge to the learning and long-term retention of words in SD.

Bier et al. (2009) compared spaced retrieval and simple repetition in semantic therapy for a 70-year old female with SD who completed two treatment sessions a week for three weeks. Using alternating treatments across sessions, the patient was asked to answer questions about each word stimulus (four words/condition taken from unnamed items in assessment). Outcome measures included item and attribute naming of targeted and untargeted items completed at each treatment session, and five weeks post-intervention. Additional measures at baseline were completed to describe participant characteristics. Results showed significant positive effects on item and specific attribute naming of the trained items that were maintained at five weeks post-intervention. No generalization of naming ability and no differences between spaced retrieval and simple repetition were observed.

Strengths of this study included well-described participant characteristics, well-designed and appropriate procedures, appropriate stimuli selection, and appropriate statistical analysis. This study had several limitations. While the stimuli were well-selected, there were only four in the training condition, and there were very few training sessions overall. It should also be noted that all 24 words were presented for naming at the end of every session, which presents the idea of practice effects for words that are not supposed to be practiced in the session.

Overall, this study provides suggestive evidence that learning unknown words is possible in SD, and that learning can be maintained for five weeks.

Heredia et al. (2009) examined retention and maintenance rates for word relearning in a 53-year-old woman with SD. The patient completed a month-long daily independent home program that used unnamed stimuli from baseline measures; progress was tracked using a tracking sheet. Outcome measures included target and control word naming immediately post-intervention and at one- and six-months post-intervention. Additional measures at baseline were completed to describe patient characteristics. Order during testing was varied to avoid rote recall. Results showed a significant treatment effect immediately post-therapy, at one-month post, and at six-months post. The patient also demonstrated the ability to generalize her

knowledge to the same item in different visual forms (i.e., not the photo she studied).

Strengths of this study include thorough summary of patient's history and characteristics, appropriate stimuli selection, well-described procedures, order control during testing, and appropriate statistical analysis. There were several limitations. There was a lack of control in that the therapy was self-administered, and there was some evidence that some words were learned in a phrase provided by her husband.

Overall, this study provides compelling evidence that learning words is possible in SD, and that learning can be maintained for six months.

Jokel and Anderson (2012) compared patterns of errorless/errorful and active/passive learning on anomia in seven patients with SD. Over 12 sessions, two per day, two-three times per week, patients learned words in all four conditions (active/errorless, active/errorful, passive/errorless, passive/errorful). Target words in each condition included four words the participant could recognize but not name (+S) and four words they could neither name nor recognize (-S). Outcome measures included naming of items after every session, immediately post-intervention, and at one- and three-months post-intervention; and item comprehension of -S words after every treatment set. Additional measures at baseline were completed to describe participant language abilities. Results showed that significant learning was found in all conditions, but errorless learning, whether active or passive, was significantly more effective than errorful. These effects were stronger for +S words than -S words. This pattern persisted one-month post-intervention. At three-months post-intervention, there was no effect of errorless vs. errorful, but there was of +S. Comprehension was also found to improve across all conditions.

Strengths of this study include a well-designed, well-described method, appropriate stimuli selection, and appropriate statistical analysis. Weaknesses include the possibility of cue contamination across conditions, and there were multiple sessions per day, introducing the possibility of fatigue effects.

Overall, this study provides compelling evidence for the positive effects of semantic therapy in SD, particularly errorless learning, and that these effects can be maintained for a month, or more. It also provides evidence for the additional effects of semantic knowledge on word learning.

Case Control Design

Case control designs are a quasi-experimental design that can test differences between groups. Case control designs are used in the anomia literature to test the efficacy of one type of therapy over another type in a group of people with similar language difficulties. Results must be interpreted with caution because there cannot be true randomization, and with the topic of dementia, the groups are small. This design provides stronger evidence than a single subject design.

Cherry and Simmons-D'Gerolamo (2004) compared the effects of spaced retrieval learning in two people with probable AD (pAD) who had received training 18 and 24 months previously, and two with pAD who had not. This study took place in nine sessions over three weeks, using the same stimuli as the earlier training study. Baseline measures were largely cognitive and memory-based with one vocabulary test for language. The participant was asked to hand the experimenter the target object for the session when they heard a beep; the time interval expanded after a successful trial. Outcome measures included comparing the post-intervention raw scores from training 1 and 2 for those from the previous study, and by comparing their post-intervention performance to the new participants'. Results showed that a second round of training did not improve performance, and there was no difference between groups, indicating no long-term benefits of training. Performance improved throughout all sessions for all participants, showing overall positive effects of treatment.

Strengths of this study included well-described methods and appropriate procedures. This study had several limitations. The results were based on visual inspection only, and no baseline equivalence was demonstrated. The latent period between training for those in the experimental group was also very long, perhaps not appropriate for a progressive disease. A limitation for the field of speech-language pathology is that baseline language was not assessed, only one vocabulary test was used.

Overall, this study provides suggestive evidence of the possibility of word learning in pAD, but no evidence of long-term effects of spaced-retrieval on word learning.

In a second study using the same method and interpretive procedures, **Cherry and Simmons-D'Gerolamo (2005)** compared the performance of five participants who had received previous training in spaced retrieval and five participants who had not. The latency period between training in this study ranged from 6-11 months. The results showed that those who had previously taken training had fewer failed trials and longer retention times than those who had not

previously received training; an overall positive effect for previous training. This advantage disappeared over time, and all participants continued to improve as training continued. Strengths and weaknesses of this study are the same as the previous study, although a specific strength of this study is that a shorter latency period was achieved.

Overall, this study provides suggestive evidence that word learning can occur in AD, and there may be some long-term effects of spaced retrieval therapy.

Flanagan et al. (2016) compared the efficacy of a semantic feature training program in two AD patients and a patient with progressive nonfluent aphasia (PNFA; another subtype of PPA with anomia of a non-semantic nature). Stimuli came from two high frequency categories (fruit; animals) divided into typical or atypical exemplars. Training occurred over three-four weeks, in two phases. In the first phase, participants would study either atypical fruits and typical animals or typical fruits and atypical animals. In the second phase, that would be switched. Each session used picture naming, category sorting, and semantic feature verification tasks. Outcome measures included item naming of target and control (tool category) items midway through treatment, immediately post-treatment and at a six-week follow-up. Additional measures at baseline were completed to describe participant characteristics. Results showed that both the AD patients improved significantly in naming animals, but not fruits or control categories. One maintained this improvement significantly when tested at six weeks. In contrast, the participants with PNFA did not show any improvement. There was no significant effect of typicality.

Strengths of this study included well-described participant characteristics, well-designed and appropriate procedures, and appropriate statistical analysis. This study had a few limitations. While there was proper explanation for the chosen treatment categories, there were only two. There were also no control items within the treatment categories, inhibiting analysis of within-category generalization.

Overall, this study provides suggestive evidence that people with AD can learn words and that it is possible to maintain gains for six weeks. It also showed that semantic category has an effect on learning.

Hung et al. (2017) studied the effects of Transcranial Direct Current Stimulation (tDCS) over the left temporoparietal cortex paired with semantic feature training on anomia in four people with SD and one with AD. The participants completed ten sessions over two weeks. Target items were presented and named along with their semantic features. The participant was then cued to give the name, features, and a novel sentence of each target word. Stimuli were photographs of the items from the participant's home, adding personal relevance. Outcome measures included item naming immediately post-intervention and at six weeks post-intervention. Additional measures at baseline were completed to describe participant characteristics. Results showed significant improvement for trained items immediately following therapy, but fell to baseline at six weeks. Some categories (e.g., inanimate objects) showed more robust growth than others, (ex: familiar people). When results were interpreted on an individual basis, participants with SD showed more improvement than the participant with AD.

Strengths of this study included well-described and designed procedures, appropriate stimuli selection, and appropriate statistical analysis. This study had several limitations. Although items were sorted into conditions quasi-randomly, naming for treatment items was significantly higher than for the control items at baseline. The study also did not have a control group who received training without tDCS, and so no conclusions can be drawn about the naming treatment alone.

Overall, this study provides suggestive evidence that naming can improve in dementia, and that retention can be affected by semantic category.

Discussion

This critical review examined interventions for anomia in individuals with dementia. All of the eight studies provided suggestive evidence of positive benefits to naming for individuals with dementia. Importantly, these benefits were noted across a variety of methods and variables, and many of the studies noted maintenance of therapy effects.

Post-hoc analysis of the evidence was done in order to describe two factors that appeared to have an influence on results of the studies. One factor that appeared to influence outcomes across these studies was the type of stimuli included. For example, one study found positive effects using stimuli of high personal relevance, though no control items were used (Jokel et al., 2006). Two studies presented evidence that words for which there remained some semantic information can be maintained longer (Jokel & Anderson, 2012; Jokel et al., 2006). Two studies found that the semantic category of the stimuli can affect word-learning and maintenance rates as well (Flanagan et al., 2016; Hung et al., 2017). This provides evidence of the importance of stimuli

selection, which can be manipulated to fit what is most functional for the client.

Another factor presented in this review was learning pattern. No evidence was found for a benefit of spaced retrieval over other learning methods, but positive effects were still seen (Bier et al., 2009; Cherry & Simmons-D'Gerolamo 2004 & 2005). Likewise, semantic feature analysis was found to be effective (whether paired with tDCS or not), but there was no control group, so evidence for its superiority over other methods is lacking (Flanagan et al., 2016; Hung et al., 2017). Errorless learning, however, was shown to be more effective than errorful learning (Jokel & Anderson, 2012). Self-study protocols were also found to facilitate word learning (Heredia et al., 2009; Jokel et al., 2006). Overall, the method of learning does not seem to have a large effect on learning and maintenance, rather, it is about the experience, or perhaps effort, of learning itself.

More research needs to be done in this field, and on a bigger scale. Because this area has been explored so little, there are many different paths future research can take, to create a more solid evidence base to improve clinical practice:

a) Future research should focus on a higher number of participants so more robust conclusions can be drawn from results.

b) All the studies included in this review had very short time frames for therapy. It is important to know what results can be earned in longer therapeutic time frames, as this may lead to more efficient and less redundant therapy.

c) Future research should include more studies of comparison in order to establish best practices for learning methods and stimuli inclusion.

Clinical Implications

Treating anomia in clients with dementia is possible, and results can be maintained.

Anomia therapy is an important consideration for maximizing quality of life in people with dementia. Functional consideration in these therapies is important, and may considerably ease the process of learning and help maintain it. The current available evidence provides a base for planning helpful and effective anomia therapy for this population. There are many therapeutic factors for the clinician to consider, and when tailoring programs to an individual in such a variable population, it may be difficult to make all of

the right choices. With a client-centered approach to the evidence, S-LPs will be well-equipped to provide the best care that for the clients and their families.

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