Word Generation Deficits in Alzheimer's Disease: Insights from a Priming-Based Study

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Abstract

Alzheimer's disease (AD) is the most prevalent form of dementia. In AD, degeneration occurs in cortical structures, leading to the loss of conscious cognitive-linguistic functions. However, the existing literature presents contradictory findings regarding priming effects in AD. While some studies suggest that priming deficits appear from the earliest stages of the disease, others indicate that priming remains relatively preserved until the later stages. The present study aimed to investigate the impact of AD on implicit memory using a priming-based word generation task. Specifically, we sought to determine the easiest and most challenging word generation tasks for individuals with cortical dementia.

Fifteen right-handed, Malayalam-speaking individuals with cortical dementia of the Alzheimer's type, aged 50–70 years, participated in the study. All participants were in the early stages of dementia, ranging from six months to one year post-onset. Four experiments were conducted across different semantic categories: abstract words, synonyms, antonyms, and semantically related words. Each experiment assessed how many words participants could generate within a 20,000-millisecond timeframe. A list of ten-word stimuli was presented using DMDX software, and participants were instructed to generate as many words as possible within the given category and time limit. The number of words produced and linguistic errors were recorded and analyzed.

Statistical analysis revealed a significant difference (p < 0.01) in the number of words generated between the following category pairs: abstract vs. antonyms, abstract vs. semantically related words, and synonyms vs. semantically related words. The data indicated that generating abstract words was the most challenging task, while generating semantically related words was the easiest. As the word generation tasks progressed, participants' performance declined, with noticeable impulsivity and attention deficits. This decline may be attributed to concurrent metabolic issues, such as impaired bowel and bladder control and disorientation in time and place. Additionally, participants frequently failed to respond to the generation tasks. For all experiments, individuals with cortical dementia exhibited circumlocution and tip-of-the-tongue errors. The observed decline in word retrieval is consistent with cortical atrophy patterns, particularly in the posterior temporal and parietal cortex–areas crucial for lexical retrieval (Vonk et al., 2018). Lesions in these regions disrupt verbal processing and lexical retrieval abilities, including vocabulary access and semantic memory recall (Shao et al., 2014). The medial parietal cortex, lateral temporal cortex, temporoparietal junction, and angular gyrus–nodes of the default mode network (DMN) language subsystem–also play a role in these deficits (Andrews-Hanna et al., 2010).

Our findings highlight the significant challenges individuals with cortical dementia face in generating abstract words, likely due to the complex cognitive-linguistic processing required. Additionally, misbinding errors were observed across multiple semantic categories, further indicating the deterioration of lexical retrieval mechanisms in AD. Understanding these specific impairments may aid in developing targeted interventions for language deficits in individuals with cortical dementia.