

Language Rehabilitation in Alzheimer's Disease-Verbal Fluency Clusters

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Received date: October 30, 2017; Accepted date: November 20, 2017; Published date: November 21, 2017

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Abstract

Verbal Fluency (VF) is a neuropsychological tool in which the participant is asked to produce as many items (animals, fruits, vegetables and others) as quickly as possible, in 60 secs. In the present study, semantic verbal fluency animals (VF_a) and fruits (VF_f) were compared using clustering strategies in Mild Alzheimer Disease (MAD) subjects (100) and controls (CG) subjects (201). Results demonstrated that spoken clustering items on VF_a were directed by semantic similarities in CG. On the other hand, VF_f spontaneously generated phonological clusters neglecting semantic similarities. For VF_a CG had the search mode component of executive function only under the premise of semantic features, leaving articulatory and phonological aside. MAD group had the search mode component under the premise of phonological features or none. Language rehabilitation in MAD should start early, considering articulatory and semantic approach to achieve greater reliability of efficacy.

Keywords: Language; Alzheimer disease; Verbal fluency

General Information

Language impairment in Alzheimer's disease primarily occurs because of decline in semantic and pragmatic levels of language processing [1-2] so language rehabilitation in AD is focused on a semantic approach, also because articulatory errors are thought to be frequent only in the later stages of the disease [3]. Lexical access difficulties, presence of anomies, paraphasia, intrusions, omissions and replacement of words [4-6] with mild related changes on the phonological and grammatical level are some common findings in mild AD [5-8]. Motor speech disorders of neurological origin can be classified as dysarthria, apraxia of speech and neurogenic acquired stuttering, caused by weakness, spasticity, incoordination or rigidity; as a deficit of programming movements of speech, with intact and functional musculature [9] and as interruptions of speech fluency respectively. All these aspects of language can cause articulatory errors, so they are called phonetic errors and were largely described in frontotemporal lobar degeneration, primary progressive aphasia and primary progressive apraxia of speech [10-12].

Verbal fluency tasks are used within clinical and research setting with the focus of evaluating executive functions and semantic memory, although the theoretical understanding of what is measured and the abilities that underline the performance are yet unknown [13].

Intracategorical processes involve the search and retrieval of category exemplars belonging to the same subcategory (i.e. clustering). Clustering procedures are thought to relate to spreading activation in a semantic or lexical network and may expose these differences and are thought to expose components of semantic memory [14].

This Study is part of a research project (CAAE 59143616.6.0000.5505) approved by the Ethics Committee of São Paulo Hospital, Federal University (UNIFESP). All invited subjects and their legal representatives agreed to participate on the research and signed the Informed Consent Form before the evaluation. All subjects were

Brazilian Portuguese native speakers and were divided into two groups: CG (n=201), followed at a geriatric outpatient clinic and patients with Mild Alzheimer Disease -MAD (n=100), followed at a Behavioural Neurology Outpatient Clinic. The groups were further divided by age (60 to 69 years, 70 to 79 years, and 80 to 89 years and education (0<4 years, 5<8 years, and 9<18 years). For the MAD group, the inclusion criteria were based on the American Psychiatric Association (DSM-V), 2014, and the National Institute of Neurological Disorders and Stroke, National Institute of Health, 2009, criteria for probable AD criteria [15,16]. Exclusion criteria were any other neurological or psychiatric disease in both groups (except for behavioural disturbances that could be attributed to AD) and non-corrected sensory deficits. The CG was defined as participants who achieved normal scores in the neuropsychological evaluation (age- and education- corrected) and had no evidence of functional decline. All participants were initially assessed for cognitive impairment using the Brazilian version of the Mini-Mental State Examination (MMSE) [17-20]. Clock Drawing Task (CDT) [14]; VF_a [15], VF_f [16] and the Clinical Dementia Rating (CDR). Verbal fluency total score and clustering procedures were applied. In VF_f, clustering subcategories were based on articulatory proximity (IPA, International Phonetic Association, 2015) in Brazilian Portuguese. Demographic data showed a greater frequency of individuals between 60 to 69 years (52%) in the CG, a higher frequency of the 70 to 79 age group (49%) and 80 to 89 years (36%) in MAD group vs CG. We observed that all variables had significance (p<0.0001), but only VF_f has a good discriminant capacity between CG and MAD with AUC>0.8. We also observed that VF_f (AUC=0.75) differs significantly from VF_a (AUC=0.86). Clustering strategies on VF_f were determined by articulatory similarities in CG and turned to none in MAD. Structures underlining language might be arranged in layers that were deteriorated in AD [21,22].

ROC curves for each age group showed that the discrimination power between CG and MAD increased with age for MMSE, VF_a and was at its highest for the 80-90 years range (AUC>=0.8), but, VF_f was comparatively better at discriminating for all age groups.

Our findings indicated that different underlying language processes account for SVF performance and not only the knowledge of meaning is critical to achieve success. VFa the mostly used and studied variant of verbal fluency revealed prototypical semantic based specimens by clustering analyses (which leads to automatic activation of closely related neighbors), but not Vff, for which there seems to have an endogenous articulatory basis.

Accuracy showed different indices between VFa and Vff, also showed that articulatory deterioration might be an important approach in language rehabilitation since early stages. Different recruitment on executive function of verbal fluencies subnetworks might be responsible for those differences. Semantic and phonological operations could be interactives and overlapping processes and must be thought together in AD therapy targets regarding effectiveness and prevention. Articulatory problems in AD should be further investigated.

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