Deficits of case marker processing in persons with mild cognitive impairment

Abstract

The purpose of the current study was to investigate whether persons with mild cognitive impairment (MCI) showed deficits in processing case markers compared to normal elderly adults (NEA). Results revealed that individuals with MCI presented significantly lower accuracy than the NEA group on a case marker processing (CMP) task. Both groups showed greater difficulties in the passive sentences than sentences with the transitive verbs. The current results suggested that individuals with early stage of dementia started presenting deficits in case marker processing compared to the control group.

Introduction

Several studies have reported that individuals with mild cognitive impairment (MCI) showed similar patterns of language deficits compared to persons with Alzheimer's disease (AD), presenting decreased semantic processing but with preserved syntactic abilities (Altmann, Kempler & Andersen, 2001; Croisile et al., 1996; Kavé & Levy, 2003; Rochon, Waters & Caplan, 1994; Taler & Phillips, 2008; Vuorinen, Laine & Rinne, 2000). Most of these findings were based on the data obtained from transcribing connected speech and analyzing its syntactic features. However, the sampling procedures of connected speech have some limitation, given that participants can avoid producing complex syntactic structures in their spontaneous speech. Therefore, it is cautioned to interpret the connected speech samples and draw any conclusions that the MCI and AD groups were not impaired in their syntactic abilities.

Some researchers employed sentence production tasks, which controlled vocabulary and syntactic structures to examine whether persons with AD were impaired in sentence production. Results revealed that the AD group showed significantly worse performance than the normal elderly adults (NEA) on the controlled sentence production tasks (Altmann, Kempler & Andersen, 2001; Altmann, 2004; Bates et al., 1995). Based on these findings, the current study developed a case marker processing task with a limited set of vocabulary and syntactic structure (active sentences with either two- or three-place transitive verbs and passive sentences) to examine syntactic abilities in persons with MCI. Case markers play a critical role in Korean sentences given that case markers are the important index of the thematic role assignment in Korean. The current study investigated whether individuals with MCI were impaired in processing case makers compared to the NEA group.

Methods

Thirty-seven individuals (21 NEA and 16 MCI) participated in the study. Persons with MCI met Petersen's most recent criteria (Petersen, 2004) diagnosed by trained neurologists. Their Clinical Dementia Rating (Hughes et al., 1982) score was 0.5. The NEA group showed normal range of performance on Seoul Neuropsychological Screening Battery (SNSB) (Kang & Na, 2003) and Korean Mini-Mental State

Examination (K-MMSE) (Kang, Na & Hahn, 1997). They also showed normal range of performance on Geriatric Depression Scale (GDS) (Jung et al., 1997) and Seoul-Instrumental Activities of Daily Living (S-IADL) (Ku et al., 2004). Both groups had no history of Parkinson's disease, brain injury or stroke.

The case marker processing (CMP) task consisted of three syntactic structures: 1) active sentences with two-place transitive verbs, 2) active sentences with three-place transitive verbs, and 3) passive sentences, and there were eight items for each syntactic structure, resulting in a total of 24 items. The CMP task consisted of two steps. In the first step, a picture was presented on a touch-screen computer with nouns and verbs provided in letters. Examiners point to each argument in the picture and read the nouns and verbs to participants. In the second step, the same picture was displayed and participants were asked to fill in the blanks of a sentence describing the picture by choosing relevant case markers. An example of the display of the stimuli on a computer screen was provided in **Figure 1** for each step.

Results

A two-way mixed ANOVA (Group x Sentence type) was performed for the accuracy of the CMP task. The main effect for the group was statistically significant, $F(1, 35)=20.084$, $p<.001$, with the MCI group presenting worse performance than the NEA group. The main effect for the sentence type was also statistically significant, $F(2, 70)=5.582$, $p<.01$, with the highest accuracy observed in active sentences with two-place verbs, and then active sentences with three-place verbs, and the lowest scores found in the passive sentences. Bonferroni's post-hoc analyses revealed that there were only significant differences between active sentence with 2-place verbs and passive sentences. The sentence type by group interaction was not significant. Accuracy data were provided in **Figure 2** for both groups.

Discussion

The current results revealed that persons with MCI showed significantly lower accuracy in the CMP task than NEA, indicating that individuals with MCI were impaired in processing case makers. These results were consistent with previous findings, which reported that persons with AD showed deficits in controlled sentence production tasks (Altmann, Kempler & Andersen, 2001; Altmann, 2004; Bates et al., 1995). In the CMP task, differentially greater difficulties emerged in the passive sentences than sentences with 2-place verbs for both groups. Greater computational demands on the passive sentences may account for these findings. The current study suggested that deficits of syntactic abilities were observed even in the early stage of dementia when the controlled case marker processing task was employed.

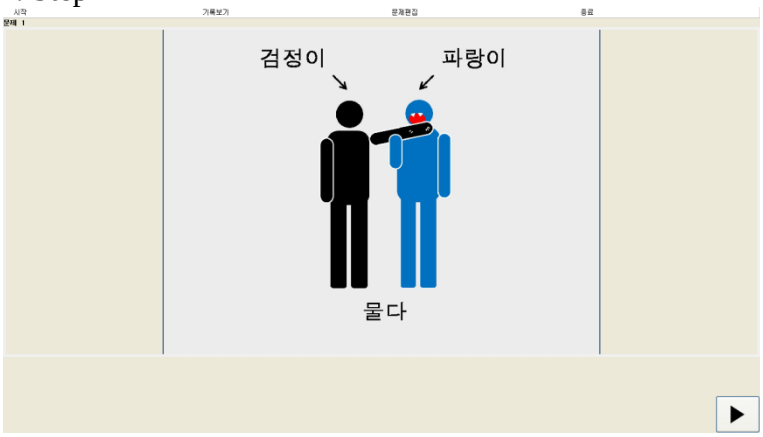
References

Altmann, L. J. P., Kempler, D., & Andersen, E. S. (2001). Speech errors in Alzheimer's disease: Reevaluating morphosyntactic preservation. *Journal of Speech, Language, and Hearing Research, 44,* 1069-1082.

Altmann, L. J. P. (2004). Constrained sentence production in probable Alzheimer's disease. *Applied Psycholinguistics, 25,* 145-173.
Bates, E., Harris, C., Marchman, V., Wulfeck, B., & Kritchevsky, M. (1995). Production of complex syntax in normal ageing and Alzheimer's disease. *Language and Cognitive Processes, 10*(5), 487-539.
Croisile, B., Ska, B., Braban, M. J., Duchene, A., Lepage, Y., Aimard, G., & Trillet, M. (1996). Comparative study of oral and written picture description in patients with Alzheimer's disease. *Brain and Language, 53,* 1-19.
Hughes, C. P., Berg, L., Danziger, W. L., Coben, L. A., & Martin, R. L. (1982). A new clinical scale for the staging of dementia. *The British Journal of Psychiatry, 140,* 566-572.
Jung, I. K., Kwak, D. I., Shin, D. K., Lee, M. S., Lee, H. S., & Kim, J. Y. (1997). A reliability and validity study of Geriatric Depression Scale. *Journal of the Korean Neuropsychiatric Association, 36*(1), 103-112.
Kang, Y., Na, D. L., & Hahn, S. (1997). A validity study on the Korean-Mini Mental State Examination (K-MMSE) in dementia patients. *Journal of the Korean Neurological Association, 15*(2), 300-308.
Kang, Y., & Na, D. L. (2003). *Seoul Neuropsychological Screening Battery (SNSB)*. Incheon: Human Brain Research & Consulting Co.
Kavé, G., & Levy, Y. (2003). Morphology in picture descriptions provided by persons with Alzheimer's disease. *Journal of Speech, Language, and Hearing Research, 46,* 341-352.
Ku, H. M., Kim, J. H., Kwon, E. J., Kim, S. H., Lee, H. S., Ko, H. J., Jo, S., & Kim, D. K. (2004). A study on the reliability and validity of Seoul-Instrumental Activities of Daily Living (S-IADL). *Journal of the Korean Neuropsychiatric Association, 43,* 189-199.
Petersen, R. C. (2004). Mild Cognitive Impairment as a diagnostic entity. *Journal of Internal Medicine, 256,* 183-194.
Rochon, E., Waters, G. S., & Caplan, D. (1994). Sentence comprehension in patients with Alzheimer's disease. *Brain and Language, 46,* 329-349.
Taler, V., & Phillips, N. A. (2008). Language performance in Alzheimer's disease and mild cognitive impairment: A comparative review. *Journal of Clinical and Experimental Neuropsychology, 30*(5), 501-556.
Vuorinen, E., Laine, M., & Rinne, J. (2000). Common pattern of language impairment in vascular dementia and in Alzheimer disease. Alzheimer *Disease and Associated Disorders, 14*(2), 81-86.

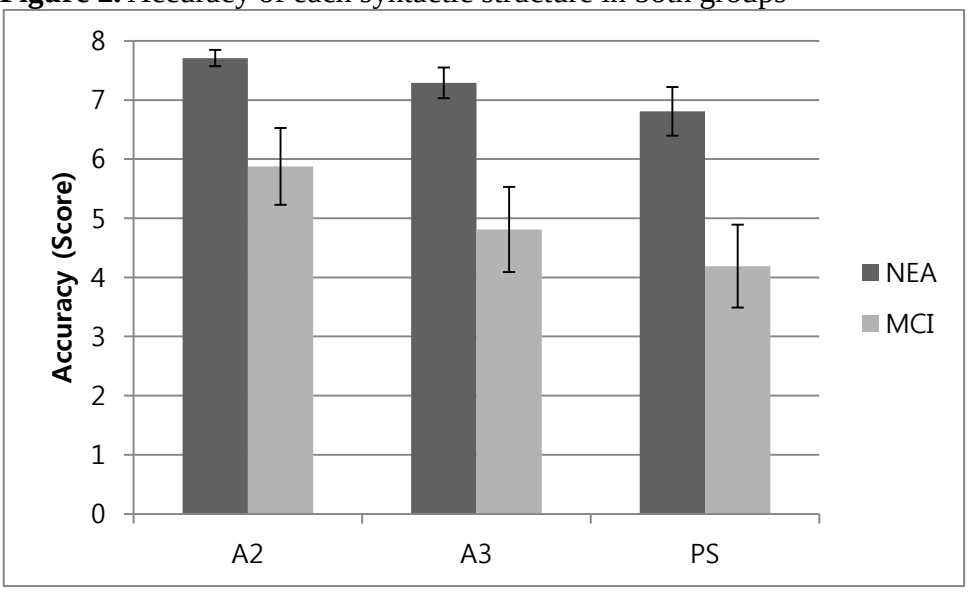
Figure 1. Two step of case marker processing (CMP) task

1. Step 1



2. Step 2

Figure 2. Accuracy of each syntactic structure in both groups



Note: NEA=Normal Elderly Adults; MCI=individuals with Mild Cognitive Impairment; A2=Active sentences with two-place transitive verbs; A3=Active sentences with three-place transitive verbs; PS=Passive sentence