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Electrophysiological Responses to Semantic and Argument Structure Violations in Agrammatic Primary Progressive Aphasia

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Introduction

Sentence comprehension requires rapid processing of semantic as well as argument structure information, i.e. number and type of verb arguments. EEG studies with healthy individuals demonstrate that semantic violations elicit an N400 response, whereas argument structure violations elicit both N400 and P600 responses (Friederici & Frisch, 2000).

Previous research indicates that individuals with agrammatic primary progressive aphasia (PPA-G) evince argument structure deficits (Thompson et al., 2011) and online semantic naming impairments (Hurley et al., 2009; Thompson et al., 2012). However, little is known about their real-time sentence processing. The current study investigated sensitivity to semantic and argument structure violations in PPA-G, using EEG paired with grammaticality judgments.

Method

Twelve individuals with PPA-G and 12 age-matched controls participated in the study. ERP responses were recorded while participants listened to correct sentences (*Susan visited the doctor and the nurse*), sentences with semantic violations (**Susan visited the doctor and the socks*), or sentences with argument structure violations (**Susan sneezed the doctor and the nurse*), and provided grammaticality judgments.

Results

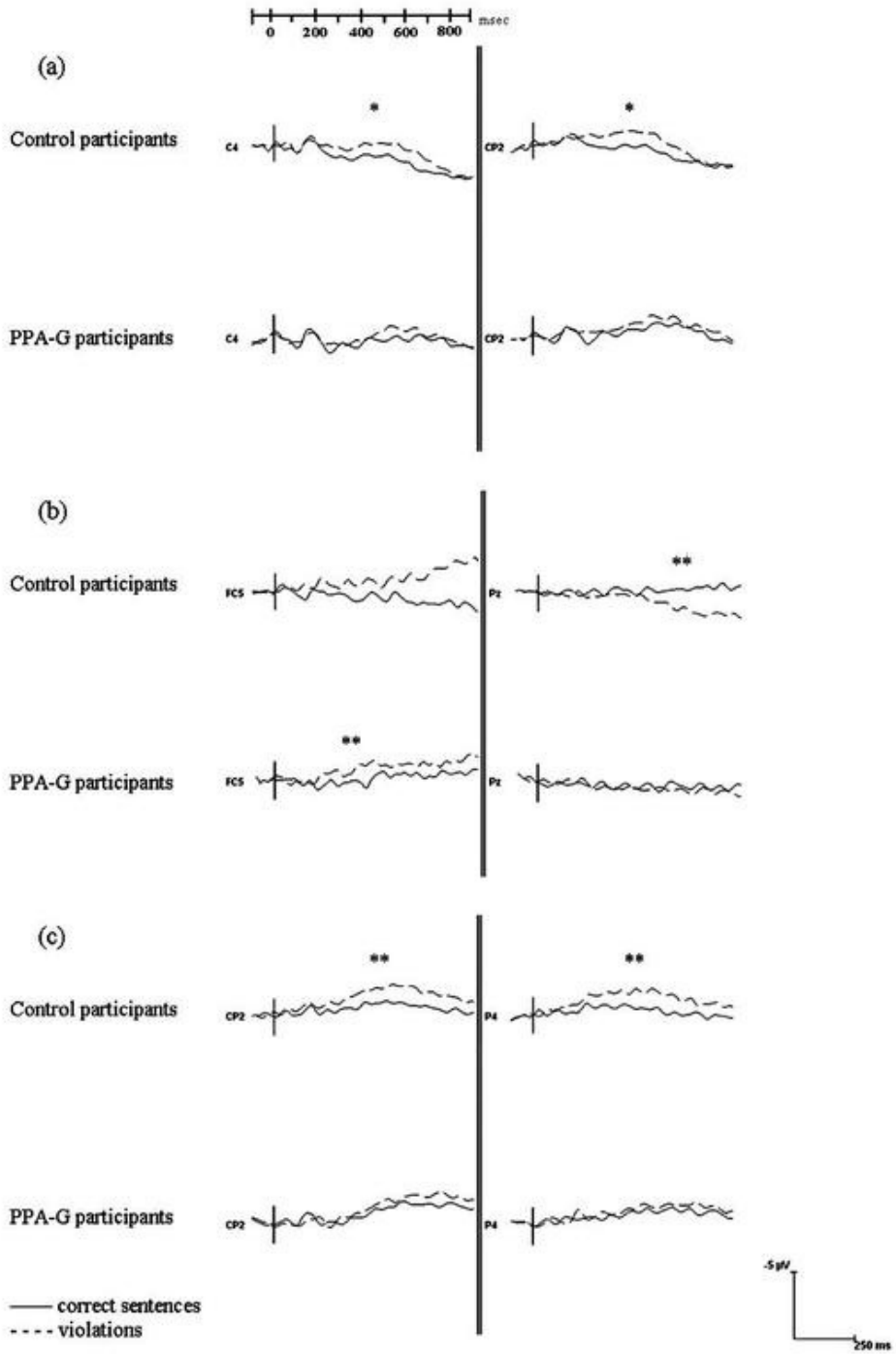
Behavioral results. Control participants were more accurate than PPA-G participants in all conditions (p 's < .01). Additionally, the PPA-G group performed more poorly in the argument structure violation compared to the other conditions (p 's < .05).

EEG results. Results are shown in Figure 1. The control group showed an N400 effect with a right centro-parietal distribution in response to semantic violations. For the PPA-G group, no significant effect was found. For argument structure violations, at the post-verbal determiner, controls showed a significant positivity distributed over parietal sites (P600), whereas the PPA-G group exhibited an anterior-central negativity but no significant P600. At the post-verbal noun, controls showed an N400 effect, but no effects were found for the PPA-G group.

Figure 1. EEG responses to (a) semantic violations (b) argument structure violations at the determiner (c) argument structure violations at the noun, for selected electrodes in controls and participants with PPA-G.

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* $p < .05$, two-tailed paired-samples t-test

** $p < .01$, two-tailed paired-samples t-test

Discussion

Participants with PPA-G exhibited deficits in detecting semantic and argument structure violations offline compared to healthy listeners. Also, unlike control participants, the PPA-G group did not show significant N400 effects in either violation condition, possibly due to an online lexical-semantic processing deficit. Additionally, EEG responses for the PPA-G group differed from controls at the determiner in the argument structure violation condition, suggesting abnormal argument structure processing in PPA-G.

References

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