

Pattern Reversal Visual Evoked Potentials in Patients with Hemineglect Syndrome

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To investigate basic visual information processing in patients with hemineglect syndrome, pattern reversal visual evoked potentials (VEPs) were recorded in 21 brain-injured patients (10 with neglect symptoms) and 6 healthy subjects. The stimulus was a checkerboard which varied in check size or temporal frequency, presented to the left or right visual field. VEPs recorded in neglect patients to stimuli presented in the subjectively neglected left visual field were comparable in amplitude to those recorded to stimuli presented in the normal right visual field. For stimuli presented centrally, there was no difference in VEPs between neglect patients and brain-damaged patients without neglect. These results support neuropsychological theories that state that the neglect syndrome is more closely related to deficits at post-sensory levels than to impairments in basic visual processing. Some evidence, however, suggests that the nature of the interaction between the two visual hemi-fields may also be altered in neglect patients. © 1995 Academic Press, Inc.

INTRODUCTION

Unilateral spatial neglect (briefly, neglect) is a syndrome associated with lesions of right parietal areas, particularly the cortex of the right inferior parietal lobe. However, there are also documented cases of neglect associated with injury to other cerebral structures, including the frontal lobes, thalamus, and basal ganglia. The appearance of neglect symptoms due to lesions of the left hemisphere is less frequent and much less serious (Vallar & Perani, 1987). Neglect patients with right hemisphere brain damage ignore stimuli located in the left side of space and do not orient themselves toward visual and auditory stimuli originating

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from this part of the space. They also do not explore their left visual hemispace with eye movements and cannot verbally report what is or what happens there. There are even some patients who ignore the left side of their own body and do not move their limbs, although no hemiplegia is detected in a standard neurological examination (Bisiach & Vallar, 1988). Finally, one case of unilateral neglect restricted to visual imagery for elements on the left side of very familiar squares, in absence of neglect disorders for stimuli located in extrapersonal and personal space, was described recently (Guariglia, Padovani, Pantano, & Pizzamiglio, 1993).

Several explanations of unilateral spatial neglect have been suggested, but may be roughly placed in one of two groups. One group of explanations emphasizes perceptual deficits—patients would not be able to detect or organize sensory information originating in the neglected hemispace. The other group of explanation emphasizes the intactness of primary sensory processing and functionally localizes the deficit to higher levels of information processing. These levels include the attentional level (neglect results from an inability to allocate attention to a specific sector of space), the representational level (neglect patients lack a conscious representation of objects and events in the left hemispace), and the premotor level (neglect patients cannot organize motor programs directed toward some parts of the left hemispace) (for reviews, see Jeannerod, 1987; Bisiach & Vallar, 1988; Rizzolatti & Berti, 1989).

The existence of higher level deficits does not imply that lower level impairments are absent in patients with neglect. Deficits at lower and higher levels might interact to produce the full, complex pattern of neglect behavior. The present research aims to determine whether some deficits in basic visual information processing might be found in neglect patients and have some differential characteristics in comparison with other brain-damaged patients.

One technique appropriate for testing basic visual information processing is the analysis of visual evoked potentials (VEPs). VEPs recorded using scalp electrodes placed over the occipital lobes can reflect cortical activity that precedes more complex processing and the programming of motor responses (for a review see Hillyard & Picton, 1987). Thus, to the extent that VEPs reflect only early visual processing, a deficit at the sensory level might be dissociated from a deficit at higher levels. A dissociation may be evident when behavioral responses are absent while VEP recording shows that sensory processing is preserved. Such a dissociation has been found in a prosopagnosic patient who was not able to recognize faces explicitly although VEPs revealed evidence for some covert form of "recognition" (Renault, Signoret, Debrulle, Breton, & Bolgert, 1989).

Until now, only two reports have recorded brain electrical activity to study basic visual information processing in neglect patients. Lhermitte,

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