ELECTROPHYSIOLOGICAL AND FUNCTIONAL IMAGING ANALYSIS OF AUDITORY LOCALIZATION IN BLIND INDIVIDUALS

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Visually challenged individuals have been shown to have enhanced non-visual sensory perception. In line with these findings, we demonstrated that a subset of totally blind participants was superior at monaural sound localization than sighted individuals. In order to investigate whether cortical responsiveness could account for the different pattern of behaviour seen in these two subsets of blind individuals, we carried out electrophysiological and functional imaging studies. First, we recorded Auditory Event-related Potentials (AEPs) during a simplified task of sound localization under binaural and monaural listening conditions in totally-blind participants and in sighted controls. The N1 and P3 components of the AEPs were more robust and posteriorly distributed in the totally blind participants who were superior at sound localization, especially under the binaural listening condition where more input is carried to the cortex. A posterior N1 component was also observed in this subset of blind participants when tested under the monaural listening condition. By contrast, the other blind individuals and the controls did not differ in terms of N1 amplitude under either binaural or monaural conditions. Moreover, the totally blind individuals who performed like sighted participants displayed a comparable P3 amplitude that was also smaller than that observed in the sighted participants. Similar results were obtained under PET investigations. During binaural sound localization, both subsets of totally-blind individuals showed a deactivation of the occipital lobe, which was not seen in any of the sighted participants. More importantly, during monaural stimulation, the totally blind participants who were superior at sound localization displayed an activation of the occipital cortex and the degree of activation was correlated to their performance in sound localization. The other blind individuals did not differ from the sighted controls in terms of activation patterns seen under monaural conditions. Our findings bring additional support and explanation for intermodal compensation in individuals visually-deprived early in life.