

Analysis of Coherence in EEGs of Hard-of-Hearing Teenagers

A. V. Shkuropat¹

Neirofiziologiya/Neurophysiology, Vol. 42, No. 3, pp. 263-274, May-June, 2010.

Received March 23, 2010.

According to the data of analysis of coherence indices of the frequency components of background EEGs of hard-of-hearing teenagers (12 to 15 years), the latter are characterized by a greater spatial regularity of delta- and theta-range oscillations in various cerebral cortex regions, as compared with the coherence in normal-hearing teenagers of the same age. This fact can be a manifestation of profound localization of generators structures initiating this slow-wave EEG activity. No clear focus of activity was found for the alpha range of hard-of-hearing teenagers; at the same time, considerable levels of coherence of alpha oscillations were observed in spatially remote cortical zones. This feature shows that the alpha-frequency activity can also be initiated, to a considerable extent, from one source localized in subcortical structures.

Keywords: hard-of-hearing subjects, auditory afferentation, teenagers, EEG frequency components, coherence.

INTRODUCTION

The auditory system is one of the most important distant sensory systems in humans; its adequate functioning is crucially necessary for the development of the ability to speak as a means of interpersonality communication in the process of ontogenesis. Defects of the functioning of the auditory analyzer within an early age make the development of communicative abilities in persons with auditory deficiency much more complicated and, as a result, induce difficulties in the course of socialization, learning, and the acquisition of professional qualities [1].

Impairments of the auditory analyzer in persons with auditory deficiency are in many cases practically irreversible. Because of this, the problem of development of the corresponding techniques and means of education and upbringing of children suffering from such defects is exclusively urgent. The creation of optimum conditions for physical and mental development of persons with defects of hearing is the final target of such methods. The mental sphere of a hard-of-hearing (HH) individuality has been examined relatively thoroughly; at the same time, studies where the functional state of the CNS of children and teenagers with auditory deficiency

was studied using objective apparatus techniques are relatively rare [2]. It is quite obvious that objective data on changes in the systems of the organism induced under the influence of the above-mentioned sensory deficiency are exclusively valuable for the development of adequate techniques of education and upbringing of a child with a hearing defect.

Among a few studies where the functional state of the brain of persons suffering from hearing defects was examined, the following ones can be mentioned. Rather clear pathological changes in the current (background) EEG were observed in deaf 15- to 19-year-old pupils of professional schools [3]. In HH patients (sensorineural deafness of noise genesis), significant increases of the power of beta-range oscillations in temporal leads was found (as compared with the EEG pattern in the control group) [4]. When the role of distant receptors in the formation of the cortical rhythmicity was examined, most (71%) deaf teenagers (13 to 17 years) demonstrated a well-manifested alpha rhythm in the occipital cortical zones, while the intensity of this rhythm in the frontal cortical regions sharply dropped. Slow waves in the EEG composition of deaf teenagers dominated relatively rarely, and such slow oscillations considerably differed from pathological delta activity [3]. In HH and deaf children, greater spectral powers of beta oscillations and slow (theta- and delta-frequency) waves were found both under background conditions and upon the action of functional loadings [1]. As is

¹ Kherson State University, Kherson, Ukraine.
Correspondence should be addressed to A. V. Shkuropat
(e-mail: nastyashkuropat@yandex.ru).