



# CLINICAL AND NEUROPHYSIOLOGICAL CHARACTERISTICS OF NEUROPTHALMOLOGICAL DISORDERS IN CHILDREN WITH SPEECH DELAY

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## ABSTRACT

The problem of late development of speech activity in young children without severe mental pathology is becoming more and more relevant every year (Baranov A.A., 2012; Larkina E.V. et al., 2013; Makushkin E.V., 2013; Asmolova G. A. et al., 2014; Borovtsova L.A. et al., 2015). The lag in a child's speech development from the age norm is observed mainly in the early stages of the formation of mental activity (Shemyakina O.V., 2012). Disorders that arise in childhood do not disappear without a trace, but can worsen over time (Kupriyova I.E. et al., 2012; Clegg J. et al., 2005; Miniscalco C., et al., 2006; Bayer J.K. et al., 2008; Durkin, K., 2010). The role of the visual analyzer in the mental development of a child is great and unique. Violation of its function causes the child significant difficulties in understanding the surrounding reality, narrows social contacts, limits spatial orientation and the ability to engage in many types of activities [4].

An analysis of special psychological and pedagogical literature has shown that the peculiarities of the development of visual perception, insufficient development of motor and visual-motor coordination delay the process of mastering objective actions by a child with visual impairments and negatively affect the process of forming their ideas about objects in the surrounding world. The operational, functional and motivational aspects of object concepts in these children are not sufficiently developed, and without special work the formation of this mental process is extended over time.

The nature of the dysfunction of the central nervous system in children with delayed speech development affects the characteristics of the generation of visual evoked potentials (VEPs). The configurations of early and late VEP components differ significantly in children with speech delay and healthy children. With delayed speech development of various origins, the amplitude of the negative VEP component is reduced in the frontal, temporal and occipital regions of both hemispheres of the brain compared to the control. It has been established that a decrease in the amplitude of positive VEP components is associated with impaired attention function.

**KEYWORDS:** visual impairment, delayed speech development, neurological disorders.

## PURPOSE

to study of clinical and neuro-ophthallogical features in children with speech development disorders.

## MATERIALS AND METHODS

105 children aged 3 to 6 years were under clinical observation. Of these, 68 were children with speech development disorders and 37 were children without speech development disorders. Registration of total bioelectrical activity of the brain (EEG), isolation and analysis of visual evoked potentials was carried out using a computer encephalograph.

Long-latency visual evoked potentials were determined per flash of 50 Lx (0.5 J) with a duration of 4 ms, the interstimulus interval was 2 s (n = 100) with a probabilistic deviation of 25%. The absolute amplitudes of the components were assessed relative to the baseline, which was calculated relative to

physical zero. The latency period (LP) of the peak was measured relative to the start of stimulation. When analyzing the obtained material, the components of the evoked potential were identified: P1 (positive - up to 60 ms), N1 (negative - up to 75 ms), P2 (up to 140 ms), N2 (up to 170 ms), P3 (up to 220 ms), N3 ( up to 260 ms), P4 (300) (up to 320 ms) [4, 5].

## RESULTS

The reason for patients to turn to a specialist was complaints of lack of speech, disruption of the stages of psycho-speech development, as a result of which a speech development disorder was identified in these patients. All patients underwent routine clinical and neurological examination, VEP, EEG and MRI of the brain.



**Table. 1**

Pathological condition in children during the neonatal period, %

Pathological conditions	1 Group, n=68	2 Group, n=37
Asphyxia during childbirth	36	5
Hyperbilirubinemia	72,5	3
Prematurity	49	5
The use of ototoxic drugs	28	6
Viral infections	13	7
Anemia	19	3

Note: \* - p-values are < 0.05 \*\* - p values are < 0.001

Asphyxia during childbirth was detected in 36% and 5% of cases, respectively, in groups I and II. In the children we examined, hyperbilirubinemia was observed in 72.5% in group II and 3% in group 1. The use of ototoxic drugs was observed in 6% of subjects in group 1 and 28% in children in group 2. Prematurity occurred in 49% of children in group 1 and 5% of patients in group 2.

At the same time, the majority of children with speech development disorders had diffuse organic neurological symptoms, as well as central insufficiency of the VII and XII pairs of the cranial nerve, anisoreflexia, and revitalization of tendon reflexes. When examining the medical history, signs of perinatal damage to the nervous system were revealed in 48 (85%) patients.

In accordance with the results obtained, in children with speech development disorders aged 2-5 years, the maximum for the P1 component was recorded in the occipital region. At the same time, in children of group I, registration of the maximum P1 component was detected in the right hemisphere, and in children of group II it was found in the left region of the brain. In children one year of age with speech developmental disorders, two maximum amplitude values of the N1 component were present in the frontal and left occipital regions. In addition, an asymmetry in the formation of the N1 component was found in these brain regions.

Consequently, when studying survey data, a wider display of interhemispheric connections was found in the group of children with speech developmental disorders compared to children without speech developmental disorders.

**Table. 2**

Characteristics of the state of bioelectrical activity of the brain in the study groups (%)

EEG data	1 group, n=68	2nd group, n=37
Delayed Maturation	40,0	8,5
Diffuse Changes	30,0	8,2
Focal Changes	25,0	4,2
Paroxysmal Activity	10,0	1,4
Epileptiform Activity	15,0	1
Variant Of The Age Norm	0	10

Note. \* - pvalue<0.001; \*\* - significant EEG differences between groups (p <0.001).

In 69.6% of patients, bilateral asymmetry and asynchronization of the EEG were detected and a wide range of changes in regulatory and organic origin of mild to moderate severity was diagnosed. A variant of the age norm was noted in 10% of patients in group 2. The EEG data obtained in children with speech development disorders indicate that children show more significant changes in the bioelectrical activity of the cerebral hemispheres than children in the healthy group.

Characteristic were significant diffuse changes in the bioelectrical activity of the brain, with a predominance of the organic nature of the changes. There was a delay in the formation of the age-related rhythm. Focal changes are represented in 25% of children in group 1, 4.2% in group 2, mainly with bursts of slow wave activity.

**Table. 4**

MRI in the Examined Groups, %

MRI data	1group, n=68	2 group, n=37
Expansion of the subarachnoid spaces	61,1	1,7
Ventriculomegaly	61,1	1,7
Focal lesions of white matter and basal ganglia	27,9	7,3
Periventricular changes	16,8	4,7
Anomaly of development	2	0

In children with speech development disorders, in most cases we observed expansion of the subarachnoid spaces (61,1%), ventriculomegaly (61,1%). The incidence of these changes in children of group 1 was 91.7% and was significantly higher

(p>0.01). In 27.9% of children in group 1 and 7.3% in group 2, focal lesions of the white matter and subcortical areas were detected. In our study, 2% of cases of developmental anomaly were identified in children with speech development disorders,



which characterizes a disorder in the maturation of nervous tissue in children against the background of intrauterine lesions.

## CONCLUSIONS

An extensive examination of children with delayed speech development using clinical, neurological, ophthalmological functional studies makes it possible to determine the structure of various factors that lead to delayed speech development in children and have an impact on the further course of the disease.

As a result of a study of the characteristics of visual evoked potentials in children with speech developmental disorders, data were obtained indicating the presence of a relationship between the degree and nature of the dysfunction of the central nervous system and their influence on the processes of generating VEP components. Thus, intercentral connections are directly dependent on early disturbances in the development of brain structures, which subsequently leads to difficulty in analyzing information. Insufficient interconnection between brain regions in children with speech development disorders causes low functional activity of the fronto-occipital and interhemispheric connections of the cerebral cortex, which in turn leads to attention deficit.

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