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Prevention of Learning Disability in the Preschool Years

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Abstract

A study of the development of higher mental functions in preschool children aimed to prevent a risk of further learning problems. Another task of this work is to identify the leading syndromes of higher mental functions retardation in preschool years. The differences in the stability / dynamics of neuropsychological syndromes were revealed in children who followed and did not followed the neuropsychological remediation.

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The development of higher mental functions in preschool children is very intense. Let us consider its different aspects. *Language development* goes in several directions: an improvement of communicative means with other people, which are the basis for restructuring of mental processes, a tool for reasoning. Besides, the preschool child's speech becomes a means for planning and regulation of own behavior [1]. *The development of perception* at this age, in fact, is a development of methods and means of orientation in space and in what about. Studies by L.A. Wenger (1993) proved assimilation in preschool years of sensory standards - dynamic representations of varieties of objects' individual properties (color, shape, size) and a correlation of relevant objects with these standards [2]. During preschool age with the emergence of more complex activities in children play the *attention* concentration and stability increase. For example, the younger preschoolers can participate in the game for about 30-40 minutes, to compare with five - six years old children whose duration of the same game increases to one hour and a half [3]. Child's *memory* is mostly involuntary; the child often does not set a conscious goal to remember something. As was shown by P. Zinchenko, the play activity needs an involuntary memory corresponding to the purpose of the game [4]. At the end of preschool age a voluntary memory begins to develop. At the preschool age the operations of *reasoning* like classification, generalization, establishing causal relationships are in the process of formation [5].

These theoretical data are also important for assessment organization. In a survey of children, especially in the pre-school age, it is necessary to pay special attention to the used diagnostic material. It should be accessible, familiar and attractive (can attract attention). Test stimulus must be presented as a clear colored image. It should be depicted as clearly as possible, and should not include any abstract details. Also, the examiner must consider limitations of perception and attention in preschoolers. While conducting a neuropsychological assessment of a preschooler the specialist must give the child a

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possibility to change different types of activities, it is also necessary to select the most informative and time-saving methods and techniques. Game-like form is the most suitable type of test (given the main activity in this age group) [6].

Subjects and methods: Our research involved 30 children assessed in the Centre of Developmental neuropsychology in the period of 2011-2013. The reasons for assessment were different complaints, mainly related to the difficulty of mastering the skills needed to prepare for school. During the assessment of the child his parents filled up a questionnaire on early development. Neuropsychological assessment included quantitative and qualitative analysis aimed to reveal the strengths and weaknesses of the child's mental development used to develop strategies and methods of remediation for this child.

All children participated in our study had no evident organic lesion of the central nervous system; these children were trained in a public kindergarten, all lived in good conditions. Among the subjects there were 20 boys and 10 girls, 16 of them were right-handed, 10 left-handed and 4 ambidextrous. Fifteen children from our group underwent a new neuropsychological assessment after the course of neuropsychological remediation consisting of complex motor, cognitive methods and special breathing exercises aimed to overcome the weakness of mental activity. The assessment of children used the material of Luria neuropsychological battery, adapted in our center for children [6]. Lurian analysis allows to differentiate learning and behavior difficulties due to the individual characteristics of the functioning of brain structures from a maladjustment due to improper upbringing [7, 8].

Results of the research:

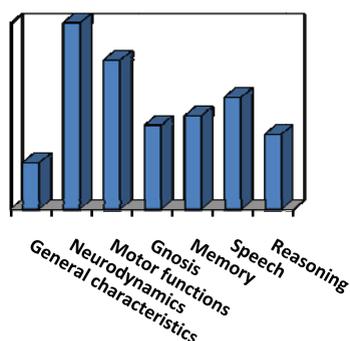


Figure 1. The degree of severity of underdevelopment in different mental spheres (scores)

An analysis of scores for mistakes in different tests (fig. 1) proves that most often the cause of child's problems is the low *neurodynamic level of mental activity* (average score is 2 from maximal score 3). It coincides with the complaints of parents that their children are smart, but inconsiderate, tire quickly in training tasks, too active etc. The study of neurodynamics was conducted both with a proofreading test and an evaluation of the child general behavior during the process of assessment. On the second place there are difficulties in *motor functions*: reciprocal coordination of hand movements, oral praxis, digital praxis, the spatial organization of graphic activity, dynamic movements and verbal regulation of movements in the tests of reproducing rhythms on instruction and implementation of conditioned reactions. The average score for motor functions is 1.6. Next is an underdevelopment of *speech*: prosodic, lexical and grammatical components of spontaneous speech, phonemic discrimination, naming of low-frequency words, understanding of logical-grammatical constructions, the use of verbal sequences. *Mnemonic function* was investigated with tests on acoustic, visual and motor memory. Errors in these tasks may indicate a difficulty of remembering the material required to prepare for school and for success in everyday life of the child. *Gnostic functions* were assessed with tests for visual, spatial, tactile, color and acoustic perception. *Reasoning* was assessed with tests for generalization (to find a common category for images), through description of pictured stories and understanding of the meaning of an oral story. Under *the general characteristics of the child*, we mean such features as critical attitude to own behavior, general knowledge and general behavior during assessment.

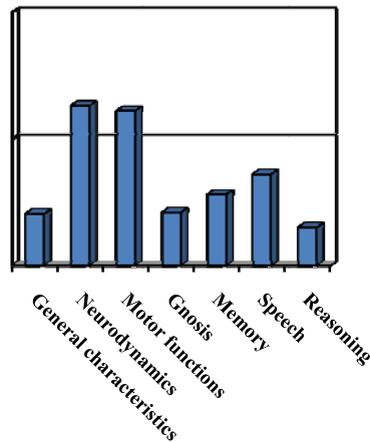


Figure 2 Number of underdevelopment symptoms in different mental spheres (%)

A qualitative analysis of symptoms of underdevelopment (fig.2) suggests that first of all in the preschool years a weakness of the first functional unit of the brain (upon Luria theory) - unit of activation is revealed [9]. Energy deficit leads to the fact that the child does not have the resources to perform many operations depending mainly from the second unit of the brain (unit of processing and storage of information), even when the last was sufficiently mature for this operation. These findings correlates with above mentioned quantitative data (scores) in preschool children. Also, quite often (in 61%) the third unit of the brain - unit of regulation, monitoring and programming of activity was deficient. The frontal lobes according to A.R. Luria are characterized by a great complexity of structure and by bilateral relationships with cortical and subcortical structures. D.B. Elkonin [10] proved that an attitude to a rule as to a condition is a component of a child's readiness for school. Paramount is the verbal regulation of behavior when external and internal verbal instructions regulate child's selectivity of action. Underdevelopment of this brain unit coincides with the complaints of parents that their child has low self-control, has problems to follow the rules, and therefore he violates the rules of behavior both in family and in kindergarten. Our survey revealed great difficulties in the test of conditioned reactions in which the echopraxic reactions appeared in conflict conditions, as well as poor dynamic features of movements - in situations of switching from one element to another one: disturbances of a smooth transition from one movement to another or from one graphic pattern to another. Also the great difficulties arose in the test for interhemispheric interaction (reciprocal coordination of hands). Less than these two units of the brain the formation of the second functional unit of the brain - unit of storage and processing of information was disturbed. Functioning of this unit provides the modality-specific processes, as well as complex integrative forms of information processing necessary for the maturity of higher mental functions.

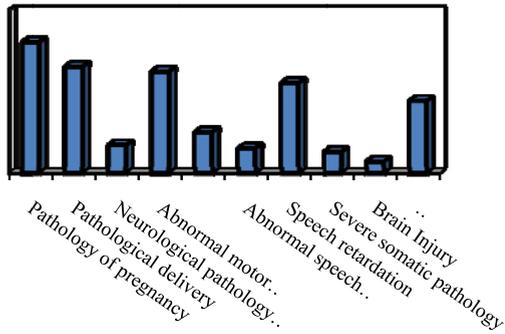


Figure.3 Relationship of the underdevelopment of mental functions with the features of early development (%)

Causes of the underdevelopment of higher mental functions can be understood through an analysis of data of early development questionnaires filled up by parents (fig.3). It can be seen that the majority of children had a pathological situation during pregnancy and/or delivery: a threat of termination, an infection or other health problems in future mothers, as well as such negative conditions as mechanical squeezing of fetus, cesarean section, etc. Also, quite often (in 62% of cases) some anomalies occur in the early motor development - a lacking or irregular step in motor development before one year of life. The third high incidence regards the delayed speech development. 36% of children had neurological diagnoses, most commonly ADHD and MMD.

An analysis of relationship between qualitative and quantitative data and early development questionnaires using Statistica 10.0 and Spearman correlation coefficient reveals statistically significant values (> 75). Pathology of pregnancy and delivery in our study correlated with a decrease of neurodynamics (first unit of the brain), with abnormal and delayed motor functions and executive functions (the third unit of the brain)

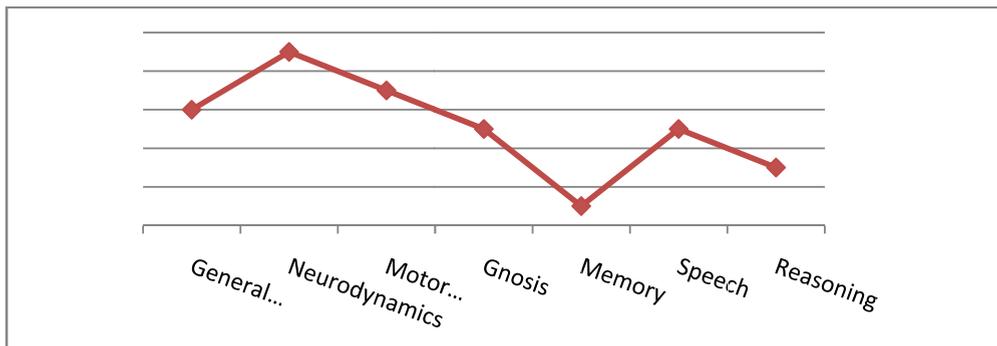


Figure.4 The role of early neuropsychological remediation in overcoming defects of higher mental functions.

Most of the assessed children had neuropsychological remediation and an neuropsychological follow-up after remediation. Statistical analysis of these data was performed through the Wilcoxon nonparametric test of significance (significant values $P > 0.005$). We see (fig.4) that the most pronounced amelioration was observed in the field of neurodynamics, as well as in the motor functions. Verbal functions as well as gnostic functions also improved after remediation. Memory and reasoning dynamics is less pronounced.

The presented analysis permits us to conclude that a comprehensive neuropsychological remediation consisting of cognitive, motor, and breathing exercises, can in most cases significantly correct neurodynamic, executive and motor

difficulties. A consecutive focus of the remediation work on the cognitive functions leads to good results in the functioning of the second unit of the brain.

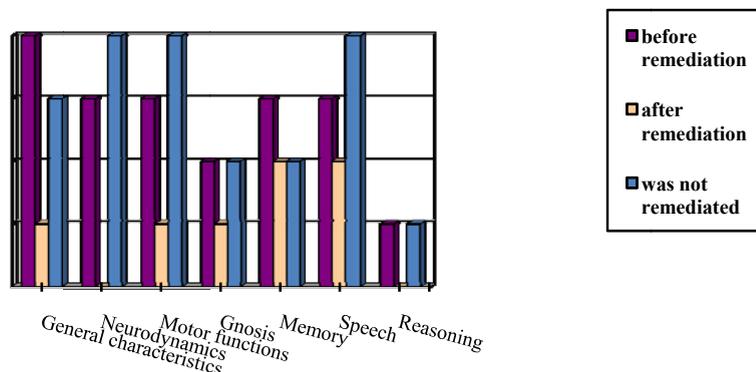


Figure.5 Comparison of children who followed and did not followed the neuropsychological remediation (scores)

To confirm that the observed dynamics is associated with remediation and not with retesting we compared two protocols of 6 years old boys, with the same early development features, both right-handers, both children at the time of the survey studied in the group of the kindergarten preparing for school (fig.5). They revealed equal scores of mental development at the first assessment. One of the boys had a course of neuropsychological remediation during three months, the other did not. The neuropsychological follow-up was effectuated in both children six months after the initial assessment. We can see that the neurodynamic, motor, and verbal scores deteriorated in the child who had no neuropsychological remediation while in his peer these scores normalized or became much better in the second one. Gnostic and intellectual functions remain unchanged without remediation and significantly improved or even normalized after it. Memory scores became better in both children. This proves that the neuropsychological remediation in the preschool age may be a prevention of difficulties at school.

The study enables us to do the following **conclusions**:

- 1) The leading syndrome of underdeveloped higher mental functions in the preschool age is attention deficit disorder and difficulties of voluntary regulation and control of own activities.
- 2) A comprehensive program of neuropsychological remediation corresponding to the current level of child development and meeting modern requirements for the organization of classes, effectively helps to overcome the revealed difficulties.
- 3) Neuropsychological remediation at preschool age can be considered a prevention of learning problems at school.

Acknowledgements

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