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PREVALENCE OF LEARNING SKILLS DEVELOPMENT DISORDERS AMONG PRIMARY SCHOOLCHILDREN IN THE CITY OF PERM

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РАСПРОСТРАНЕННОСТЬ НАРУШЕНИЯ РАЗВИТИЯ УЧЕБНЫХ НАВЫКОВ У МЛАДШИХ ШКОЛЬНИКОВ Г. ПЕРМИ

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Objective. To study the prevalence of writing and reading skills disorders in children of the 2nd–3rd grades in comprehensive schools of Perm.

Materials and methods. A continuous survey method of 160 parents was used in two schools – a comprehensive school and a school with advanced study of German. A screening test for dyslexia (Colorado Learning Disabilities Questionnaire – Reading Subscale: CLDQ-R) and a questionnaire for checking writing/handwriting skills (Handwriting Proficiency Screening Questionnaire: HPSQ) were used. To study the features of visual perception and scotopic sensitivity syndrome (Scotopic Sensitivity Syndrome – SSS), the Ian Jordan questionnaire modified by E. Kiseleva was used.

Results. The results of the screening tests revealed a slow reading rate and numerous various errors in writing, which were combined with impaired graphomotor skills, difficulties in copying text from a standard, frequent corrections and cross outs in the text. Some children still had pronunciation problems and difficulties

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with naming letters, which indicated challenges with phoneme-to-grapheme conversion, and a disorder of sound-letter correspondence. The identified features necessitated additional assistance in the learning process for 10 % of schoolchildren in grades 2–3 of comprehensive schools in Perm, including the school with advanced study of German. In 3.8 % of children with deviant variants of educational skills development, features of visual perception were revealed.

Conclusions. Perm schoolchildren demonstrated a high prevalence of writing (15.6 %), reading (7.5–9.0 %) and handwriting (9.4–10.6 %) development disorders.

Keywords. Primary school students, dysgraphia, dyslexia, learning skills impairment.

Цель. Изучение распространенности нарушений письма и чтения у детей 2–3-х классов общеобразовательных школ г. Перми.

Материалы и методы. Использовался метод сплошного анкетирования 160 родителей в двух школах – общеобразовательной и с углубленным изучением немецкого языка. Применялся скрининговый тест для выявления дислексии (Colorado Learning Disabilities Questionnaire – Reading Subscale: CLDQ-R), анкета для проверки навыков письма/почерка (Handwriting Proficiency Screening Questionnaire: HPSQ). Для изучения особенностей зрительного восприятия и синдрома скотопической чувствительности (Scotopic Sensitivity Syndrome – SSS) использовалась анкета Ian Jordan в модификации Е. Киселевой.

Результаты. Скрининговые тесты выявили низкий темп чтения и многочисленные разнообразные ошибки при письме, которые сочетались с нарушением графомоторных навыков, трудностями копирования текста с эталона, частыми исправлениями и зачеркиванием текста. У части детей сохранялось нарушение звукопроизношения и сложности в названии букв, что свидетельствовало о трудностях трансформации фонемы в графему, о нарушении звуко-буквенных взаимоотношений. Выявленные особенности обусловили необходимость дополнительной помощи в процессе учебы 10 % школьников 2–3-х классов общеобразовательных школ г. Перми, в том числе в школе с углубленным изучением немецкого языка. В 3,8 % случаев у детей с девиантными вариантами развития учебных навыков выявлялись особенности зрительного восприятия.

Выводы. У школьников г. Перми продемонстрирована высокая распространенность нарушения развития письма (15,6 %), чтения (7,5–9,0 %) и почерка (9,4–10,6 %).

Ключевые слова. Младшие школьники, дисграфия, дислексия, нарушение учебных навыков.

INTRODUCTION

Problems of school adaptation and maladaptation remain the focus of pediatric science and are interdisciplinary in nature. One of the clinical variants of partial neurodevelopmental disorders is dyslexia and dysgraphia. Dyslexia/dysgraphia is a condition caused by impaired development of reading and/or writing skills, with a selective and persistent inability to master reading/writing skills despite normal intellectual (and speech) development and the absence of sensory impairments (visual and auditory analyzers) under optimal learning conditions [1].

Successful acquisition of learning skills is based on hierarchical interaction between complex neural networks that combine various methods and strategies for processing information of different modalities.

Traditional school education uses a synthetic-analytical teaching method, which requires learning the visual image of letters, analyzing the sequence of sounds and letters, transforming phonemes into graphemes when writing and graphemes into phonemes when reading, activating graphomotor skills, and then writing letters in order using spelling rules. At the same time, the neuropsychological prerequisites for

writing and reading must be mature. There must be spatial representations and the level of pictorial and graphic abilities, successive functions that ensure understanding of the temporal sequence of phonemes with their subsequent transformation into a spatial series of graphemes, coordination of eye movement reactions, phonemic analysis, dynamic praxis with serial organization of movements. The process of writing and reading involves complex coordination of sensorimotor processes, which occurs against the backdrop of necessary metabolic resources, optimal maintenance, distribution of attention, sufficient working memory, optimal regulation of voluntary behavior, and motivation.

The analytical algorithm for acquiring writing and reading skills is complemented by a holistic one. Children write and/or read familiar and frequently used words based on a holistic visual and visual-spatial image of the word.

At the present stage, only some areas of the brain responsible for writing and reading skills have been studied, but there is no complete understanding of their mechanisms. Modern advances in neuroscience indicate that dyslexia/dysgraphia is a complex neurodevelopmental disorder with a multicomponent mechanism. A multifactorial model of pathogenesis has been developed, including the interaction of various regions of the genome and the modulating influence of environmental factors, resulting in the formation of a structural and functional brain phenotype of typical or deviant character in the development of writing and reading skills [2].

Empirical evidence of the hereditary nature of dysgraphia is confirmed by molecular genetic studies. Nine regions of the genome associated with reading and writing disorders have been identified (*DYX1-9*, located on chromosomes 15p, 6p and q, 2p, 3p, 18p, 11p, 1p, and Xq). Several candidate genes are also

being considered: *DYX1C1* (15q), *DCDC2* and *KIAA0319* (6p), *MPRL19* and *C2ORF3* (2p), *ROBO1* (3p) and *KIAA0319L* (1p). The heritability indicator of dyslexia is 40–70 % [3–5].

It has been proven that genetic transformations cause changes in neuronal migration and ectopia. Atypical cortical organization causes atypical organization of interzonal connections, which arises as an adaptation of white matter to morphofunctional changes during ontogenesis [6; 7].

The method of teaching writing and reading, motivation, and the reaction of the student's community can either exacerbate the predisposition to dyslexia/dysgraphia or compensate for the emerging disorder in skill development.

There are few population studies on the prevalence of the problem.

Data from 1985 indicate that 10–12 % of Russian schoolchildren have dysgraphia and 5–6 % have dyslexia [8]; in more recent studies, the prevalence of dyslexia is 11.9 % [9]. Among American schoolchildren, the prevalence of learning disabilities ranges from 6 to 17 %. There is a gender difference, with dyslexia being more common in boys¹ [3].

It is worth noting a 2019 study conducted on the initiative of the Association of Parents and Children with Dyslexia with the support of the Russian Ministry of Education and financial assistance from the Our Future Foundation. The results of the sociological survey demonstrated low public awareness of the problems faced by children with dyslexia/dysgraphia. Almost half of Russians consider the main cause of problems to be insufficient attention from parents to

¹ Rusetskaya M.N. The relationship between dyslexia and speech and visual impairments in primary school children: abstract of thesis ... Candidate of Pedagogical Sciences. Moscow, 2003; 166.

their children and a lack of necessary involvement in their upbringing and education.

The prevalence of dyslexia/dysgraphia among children in the professional audience is assessed as high by the overwhelming majority of specialists. Speech therapists and psychologists proved to be the most knowledgeable, while teachers proved to be the least knowledgeable. An accessible form of support for pupils at school is additional classes with specialists once a week, as noted by 38 % of respondents, which is clearly insufficient. Less than half of the parents surveyed who have children with problems in their families received specialized assistance, with 77 % confirming that they sought help from private centers.

Thus, the survey results demonstrate insufficient alertness to dyslexia/dysgraphia, low preparedness for its occurrence in the family, and often a lack of opportunities for its correction, which creates risks of failure to provide timely assistance, leading to educational and social maladaptation and missed opportunities [1].

The influence of ethnic characteristics and the specifics of the regional linguistic environment on the nature and epidemiology of dyslexia/dysgraphia remains a topical issue. The Perm region is characterized by ethnocultural diversity, genetic polymorphism, and a complex linguistic situation.

The aim of the study is to investigate the prevalence of writing and reading disorders among children in grades 2–3 of general education schools in Perm.

MATERIALS AND METHODS

A continuous questionnaire survey was conducted in two schools: a secondary general education school (SGE) and a secondary general education language school with in-depth Ger-

man language studies (SGLS). In addition to the traditional collection of personal and hereditary medical history, a screening test for dyslexia (Colorado Learning Disabilities Questionnaire – Reading Subscale – CLDQ-R) [10] and a questionnaire to test writing/handwriting skills (Handwriting Proficiency Screening Questionnaire – HPSQ) [11] were used, with a ranking of the frequency of complaints in the range “never – rarely – sometimes – often – always”. When analyzing the test, answers in the range “often – always” were taken into account and considered non-standard [12; 13].

To study the particularities of visual perception and Scotopic Sensitivity Syndrome (SSS), Ian Jordan's questionnaire, modified by E. Kiseleva, was used².

RESULTS AND DISCUSSION

The survey yielded 160 parental reports on schoolchildren in grades 2 and 3, of which 76 (47.5 %) were from secondary schools and 84 (52.5 %) from special language secondary schools. The average age of the children was 8.67 ± 0.40 years, of which 90 (56 %) were girls and 70 (44 %) were boys; these figures were comparable in both schools.

The results of the CLDQ-R screening test revealed slow reading and below-average reading speed in 9.4 % (9 girls, 6 boys) and 7.5 % (7 girls, 5 boys) of pupils, respectively, i.e. 16.9 % of pupils, with girls (59 %) more likely to be at risk of slow reading speed when performing text-based tasks in class. At the same time, 2.5 % of pupils (2 girls, 2 boys) had difficulties in naming letters, which indicated difficulties in transforming phonemes into graphemes and a violation of sound-letter relationships. Speech

² Scotopic Sensitivity Syndrome – SSS), available at: <https://jordansinrussia.ru/>

sound disorders persisted in elementary school in 10 % of cases in both schools, among both girls (50 %) and boys (Table 1).

Various spelling errors were found in 15.6 % of respondents, with girls predominating (60 %). Moreover, in language schools, out of 10 children, girls were more likely to have spelling difficulties (80%).

The identified characteristics of reading and writing skill development necessitated additional assistance for 10 % of students in grades 2–3, with no gender differences (girls 8, boys 8).

The HPSQ questionnaire allowed us to assess various aspects of writing in children (Table 2).

Graphomotor skill impairment was detected more often in general education schools in 15 children (6 girls, 9 boys), and in 17 children (10 girls, 7 boys) in the form of illegible handwriting, sometimes incomprehensible even to the child himself; one in ten (9.4 %) students was dissatisfied with their own handwriting (without gender differences).

Table 1

**Results of the CLDQ-R screening test in children
in grades 2–3 of general education schools in Perm**

The skill being analyzed	Detection rate in the observation group, <i>n</i> (%)	Frequency of detection SGE/SGLS, <i>n</i> (%)
Slow reading	15 (9.4)	9 (60) / 6 (40)
Below-average reading skills	12 (7.5)	5 (42) / 7 (58)
Difficulties naming letters	4 (2.5)	2 (50) / 2 (50)
Difficulties with spelling	25 (15.6)	15 (60) / 10 (40)
Speech sound disorders	16 (10)	8 (50) / 8 (50)
Needed extra help at school due to reading and writing problems	16 (10)	8 (50) / 8 (50)

Table 2

**Results of the HPSQ test among children
in grades 2–3 of general education schools in Perm**

The skill being analyzed	Detection rate in the observation group, <i>n</i> (%)	Frequency of detection SGE/SGLS, <i>n</i> (%)
Illegible handwriting for others	15 (9.4)	11 (73.3) / 4 (26.7)
Unable to read their own handwriting	17 (10.6)	10 (59) / 7 (41)
The child was dissatisfied with their own handwriting	15 (9.4)	11 (73.3) / 4 (26.7)
Unable to copy assignments from the board in time	12 (7.5)	6 (50) / 6 (50)
Often looked at the board/page while copying	52 (32.5)	29 (56) / 23 (44)
When writing, they often crossed out and corrected the text	61 (38.1)	33 (54) / 28 (46)
They complained of pain in their hands when writing	4 (2.5)	2 (50) / 2 (50)
They became tired while writing	12 (7.5)	10 (83) / 2 (17)
They often refused to write	18 (11.3)	9 (50) / 9 (50)
They refused to do their homework	5 (3.1)	3 (60) / 2 (40)

It is noteworthy that 7.5 % of children (7 girls, 5 boys) did not have time to copy the tasks from the board. One-third (32.5 %) of pupils, 60 % (32) of whom were girls, mostly from general education schools, needed to frequently compare the text they were copying with the reference text (they often looked at the board/page), which may be due to various reasons: neuropsychological syndromes (features of visual and visual-spatial perception, instability in maintaining and distributing attention, pronounced exhaustion, impaired successive functions, impaired serial organization of movements, etc.) and physiological sensory characteristics (decreased visual acuity).

Emotional tension and maladaptation may be evidenced by the high percentage (38.1 %) of children (31 girls, 30 boys) who frequently corrected and crossed out text, with girls from general education schools experiencing these difficulties more often (33 %). At the same time, 11.3 % (9 girls, 9 boys) refused to write at school and/or when doing homework, and fatigue was observed in 7.5 % of schoolchildren, more often in boys (4 girls, 8 boys) from general education schools.

In 3.8 % of observations, visual perception abnormalities were identified in the form of text instability, letter vibration, blurred lines, letter transposition, and crowding effect – in both schools, equally among boys and girls.

Anamnestic data revealed that children were taught to read and write at a very early age: the age at which they began learning to read was 4.7 ± 0.3 years, and to write – 5.2 ± 0.4 years. At the same time, in specialized language schools, the age of starting education was

significantly lower than in general education schools, both for reading (4.6 ± 0.2 and 4.8 ± 0.4 years, respectively, $p \leq 0.05$) and writing (4.9 ± 0.3 and 5.3 ± 0.2 years, $p \leq 0.05$).

Thus, schoolchildren in Perm demonstrated a high prevalence of writing disorders (15.6 %), reading disorders (7.5–9.4 %), and handwriting disorders (9.4–10.6 %). Typical symptoms included slow reading speed and numerous errors in writing, combined with impaired graphomotor skills, difficulties in copying text from a model, frequent corrections, and crossing out text. Some children continued to have speech sound disorders and difficulties in naming letters, which indicated difficulties in transforming phonemes into graphemes and impaired sound-letter relationships.

Some gender differences were identified in the questionnaire process. It was found that girls in secondary school showed pronounced emotional tension, which was expressed in frequent corrections in the text, crossing out letters and words, and uneven pressure on the pen. At the same time, schoolgirls often compared the sample text with what they had written when copying. This feature may be due to both a high level of anxiety and uncertainty in the process of performing the activity, as well as the peculiarity of mnemonic processes and visual perception.

The result was unexpected, indicating a low pace of activity in performing text tasks among schoolgirls in general and a predominance of writing errors among girls in language school. Most studies indicate that dysgraphia is more prevalent among boys in terms of frequency and severity. The result obtained requires further consideration. Perhaps the high requirements for admission to school and the

expectation of high grades from students, additional lessons with tutors, and an increased academic load in general cause the depletion of the first energy block of the brain, which regulates activation and metabolic processes, with impaired basic functions—distribution and maintenance of attention, and short-term memory processes. As a result, the regulatory mechanisms associated with the control and organization of voluntary behavior suffer, leading to an increase in the number of errors. At the same time, the results obtained may be the particularities of the sample in the study.

The identified characteristics of reading and writing skill acquisition necessitated additional assistance in the learning process for 10 % of students in grades 2–3 of general education schools in Perm, including schools with an in-depth study of German.

The failure of some children to acquire academic skills led to dysfunctional attitudes, reduced motivation at school, and refusal to complete assignments at school and/or at home.

In 3.8 % of cases, children with deviant variants of learning skills development were found to have visual perception abnormalities, which requires differential diagnosis between scotopic sensitivity syndrome and visual acuity impairment.

CONCLUSIONS

A significant background factor contributing to atypical development of reading and writing skills is unreasonably early education, leading to untimely activation of the frontal lobes, transition to symbolic activity, distortion of intra- and interhemispheric connections, followed by depletion and disruption of the proper formation of learning skills. Earlier teaching of writing and reading was significantly more common in language schools, which is probably related to the social status and value system of parents, as well as the requirements for high preschool ratings for admission to “elite” schools.

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Anisimova B.G. – data analysis, conducting the study, approval of the final version of the article.

Research limitations. The study complies with the standards of the Declaration of Helsinki and has been approved by the Ethics Committee of the Ye.A. Vagner State Medical University, protocol No. 1 dated February 14, 2024. Before the start of the study, all patients or their legal representatives confirmed their participation by signing a written informed consent form.

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