STEREOPSIS TEST AND MODIFIED TEST OF BALL TOSSING AND CATCHING IN LYING POSITION IN CHILDREN OF YOUNGER SCHOOL AGE

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Key words:
- coordiantion abilities,
- binocular perception,
- basic school,
- physical activity.

Abstract:

Introduction: At present, spontaneous physical activities in younger school children are decreased, while the movement behavior of man is one of the determining prerequisites for its success in day-to-day activities. The goal of our pilot study is to determine whether there exists a relationship between the level of depth perception (stereopsis) and coordination of upper extremities in children of younger school age.

The aim of the work: In order to reveal the relationships, connections, and patterns of relationships between the level of stereopsis and abilities to perform an unknown sensomotor task, we have tested a set of children of younger school age (N = 50).

The material and methodology: To investigate the level of stereopsis, we used the Titmus test, and to determine the level of coordination abilities of the upper extremities, we used a modified test of ball tossing and catching in lying position.

Results: Statistical and substantive significance of the effect of the quality of stereopsis to performance in the coordination test of upper extremities was confirmed as high.

Conclusions: After processing the collected data, a statistically significant relationship between the studied variables was ascertained.

PROBLEM

At present, spontaneous physical activities in younger school children are decreased, while the movement behavior of man is one of the determining prerequisites for its success in day-to-day activities. We believe that the decreased quality of visual functions may significantly affect the results of motor tests. We can also assume that if a proband has high-quality visual functions, there are primarily ideal conditions for successful execution and learning of locomotor tasks in terms of afferentation.

Over the last 30 years, research in the field of human locomotor skills was mainly focused on investigation of different aspects of fitness abilities. Thus, diagnostics and identification of coordination abilities represented a certain "vacuum". The need for deeper and more detailed knowledge of motor skills, determination and analysis of the key factors of motor potential, hierarchy of motor and somatic indicators, has its justification, and depends on the possibilities of improved diagnostics and selection of adequate means of motor skill formation [11].

Coordination processes in relation to the quality of cognitive functions are described, for example, by Hirtz [3].

Visual and motor coordination at the neurological and psychological level has been discussed, for example, by Zago, Mcintyre, Senot, Lacquaniti [17], relationship of binocular vision and visual skills is described by Blake and Logothetis [2], and connection between mobility and quality of stereopsis, or depth vision, is mentioned by Schreiber, Crawford, Fetter, Tweed [14], integration of the visual and vestibular system is a study subject of authors Wright a Glasauer [16], namely within the framework of experimental exploration of the human brain. The importance of quality of visual functions in relation to specific sports performance is mentioned, for example, by Jendrusch [5] in his study. Receiving and processing of visual information during sport activities are described, for example, by Voss [15]. Spatial perception from the viewpoint of neurobiology is used also by Hubel [4] in his studies.

Analysis of the above-mentioned facts led us to construction of scientific questions and hypotheses.

With the help of empirical evidence, acquired mainly in our teaching and coaching practice, we concluded that the quality of locomotor manifestations in children is decreased. The level of motor abilities and skills is influenced by a number of factors, some of which are clearly identifiable, and they can be diagnosed. By studying literature focused on sensomotor learning, resp. visual and motor coordination [12; 13; 18; 10; 6; 8; 7; 1; 3] discussions and consultations with specialists of the Department of Ophthalmology of the University Hospital in Pilsen, we have logically reached the hypothetical considerations of what and how the ability to perform a sensomotor task would be affected. With regards to these considerations, we were also able to carry out a more specific description, organization, and methodology of our research.

The goal of our investigation is to determine whether there exists a relationship between the level of spatial vision (stereopsis) and coordination of upper extremities in children of younger school age.

METHODOLOGY

Scientific question

Is there any relationship between the quality of stereoscopic vision and the level of coordination abilities of upper extremities in children of younger school age?

Hypothesis

The quality of stereoscopic vision affects the level of coordination abilities in children of younger school age.

This research was attended by students of the first through fifth grades of primary schools. Testing itself was carried out in May 2013 by academics of KTV FPE ZCU (Department of Physical Education and Sport Science, Faculty of Education of the University of West Bohemia) in Pilsen, in cooperation with teachers of primary schools. Within the framework of the pilot study, 10 students from each grade were randomly selected, and their results were subjected to static data processing in order to verify the validity of the used research methods.

To find out the quality of stereoscopic vision, we used the standardized Titmus stereopsis test with polarized 3D glasses, and to assess the level of coordination abilities of the upper extremities, we used a modified test of ball tossing and catching in lying position.

The Titmus stereopsis test consists of pictures with different levels of space depth perception. The tested person watches individual test components through the polarized glasses. The quality of stereopsis is measured by probands according to identification of relevant difficulty of pictures.

The test of ball tossing and catching in lying position [9] to determine the level of coordination abilities of upper extremities was modified to enable its use in children of

younger school age in terms of reduction of carried out attempts from 24 to 10. Particular needs specific to this age group (such as their ability to maintain attention) were the main reason for reducing the number of attempts in this test. During the test, the proband lays down on their back, he/she tosses and catches a tennis ball with a preferred hand. The head and spatulas touch the pad all the time, and shift of the entire body was not allowed - only the preferred arm and hand could freely move. The ball had to be tossed at least to the height of the tested person. If the ball was not caught or tossed to the specified height, the attempt was consider invalid.

For the purposes of statistical processing of data in the pilot study, the program Statistika 8 was used. With the help of this program, we tried to prove the existence of a relationship between the quality of spatial vision (stereopsis) and the level of coordination abilities of upper extremities in children of younger school age. The measure of dependence of both variables was expressed by the calculated Spearman rank order correlation coefficient. The Kruskal-Wallis test was used to determine the statistical significance of the effect of stereopsis to performance in the tossing and catching test in lying position. Substantive significance was verified by the effect size coefficient.

RESULTS AND DISCUSSION

The results of statistical analysis are presented in Table 1, and in Chart 1, 2 and 3.

Table 1. Correlation dependence matrix of age, sex, quality of stereopsis, and the level of coordination of upper extremities.

	age	sex	stereopse	coordination
age	1,00	0,00	0,21	0,47
sex	0,00	1,00	-0,08	-0,21
stereopse	0,21	-0,08	1,00	0,39
coordination test	0,47	-0,21	0,39	1,00

Spearman Rank Order Correlations, Marked correlations are significant at $p < 0,05000$

To determine the measure of dependence between the level of stereoscopic vision and the level of coordination, the Spearman rank order correlation coefficient was used. Table 1 shows that the statistically significant moderate level of dependence ($p \leq 0.05$) was determined among the variables - age and coordination, stereopsis and coordination.

The effect of the quality of stereopsis upon the results in the coordination test is statistically significant, and was determined using the Kruskal-Wallis test $H (2, N=50) =7.58$; $p \leq 0.02$. Comparison of the probands with a different quality of stereopsis is shown in Chart 1. Frequency distribution in the group according to the quality of stereopsis is shown in Chart 2. Substantive significance was verified by the effect size coefficient $\eta^2 =0.15$.

Statistical and substantive significance of the effect of the quality of stereopsis to performance in the coordination test of upper extremities was confirmed as high.

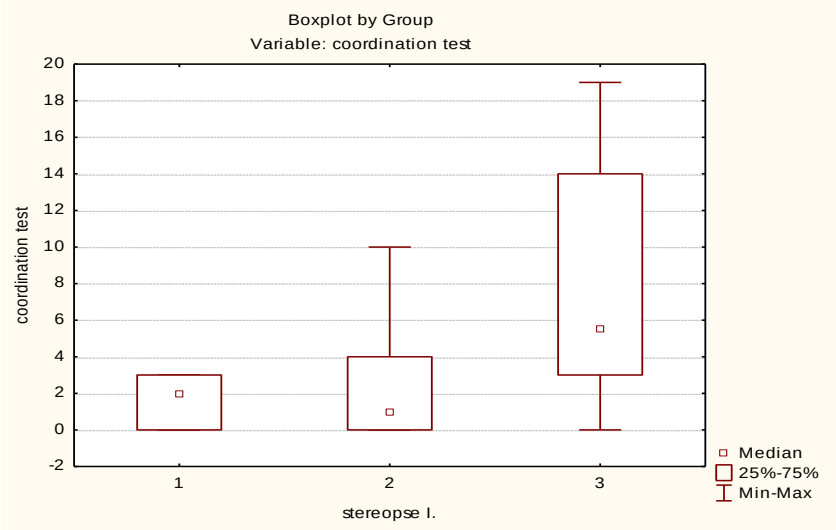

Chart 1. Graphical representation of the effect of stereopsis to performance in the ball tossing and catching test in lying position

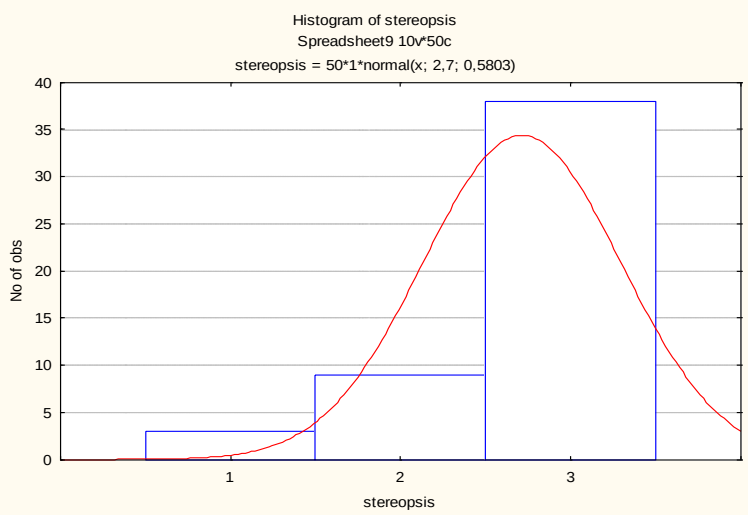

Chart 2. Histogram of frequency distribution of the group as per stereopsis criterion

Children at the age of 6 to 11 participated in this test. This age range is relatively large in relation to assessing the level of stereopsis and performance in the coordination test of upper extremities. For that reason, we also assessed the age of the probands as one of the factors affecting both variables. After the sixth year of child´s age, the development of binocular vision is completed, and stereopsis should be fully developed at the age of seven years. This assumption allowed us to examine the points at issue across the entire age spectrum of the younger school age probands.

Differences between boys and girls are statistically insignificant in terms of the quality of stereopsis and the level of coordination of upper extremities.

In all probands, stereopsis was tested in its entirety. The measured values range across the entire spectrum of scale 1-3. Maximum values in the quality test of stereopsis were achieved in 38 probands (76%). Three probands (6%) achieved stereopsis quality 1 and nine probands (18%) achieved stereopsis quality 2.

The coordination test of upper extremities was proved as difficult. Seven probands did not catch the ball at all (assessing the level of coordination abilities of upper extremities = 0).

With the increasing performance in the coordination test of upper extremities (the number of caught balls), the number of probands is decreased, see Chart 3.

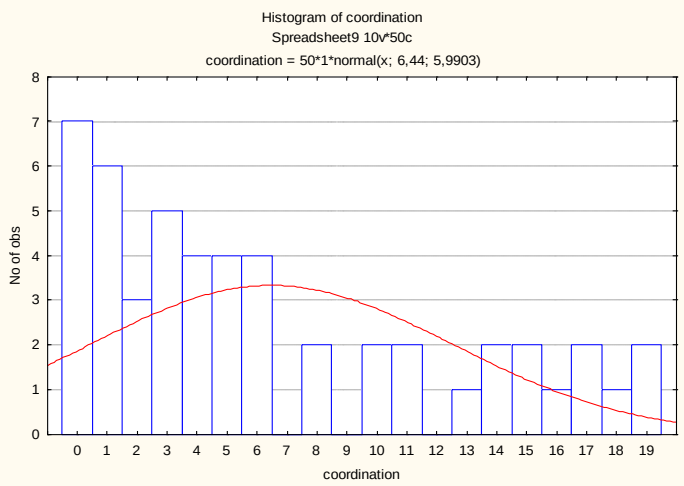

Chart 3. Graphical representation of frequency of the group as per coordination criterion of upper extremities

CONCLUSIONS AND RECOMMENDATIONS

The goal of our research was to find a relationship between the quality of stereoscopic vision and the level of coordination abilities of upper extremities in children of younger school age. We evaluated age, sex, level of stereoscopic vision of the probands, and the coordination test of upper extremities.

We can confirm the hypothesis that the "Quality of stereoscopic vision affects the level of coordination abilities in children of younger school age". The measure of dependence of both variables (quality of stereopsis and the level of coordination) has a mean statistical significance (**r_s=0.39, p≤0.05**). The effect of the quality of stereopsis to the level of coordination abilities is highly significant **(H=7.58, p≤0.02)**. Substantive significance (**η^2=0.15**) is high too. The dependence of the variables - age of the probands and the quality of stereopsis - is statistically insignificant. The dependence of the variables – sex of the probands and the quality of stereopsis - is also statistically insignificant. Sex with regard to stereopsis, therefore, probably does not play any role. Sex of the probands is not a significant factor in relation to the level of coordination of upper extremities.

Other factors, which may significantly affect the results of motor tests, include the ability of children to focus on performing motor tasks, experience with tossing and catching objects that are logically more significantly developed at this age, for example in connection with school and out-of-school physical activity. The ability of concentration and attention enables to activate both perceptual and motor skills. Therefore, it becomes one of the basic prerequisites for optimal reception of information (afferentation), its processing (brain, CNS), and finally execution (efferentation) of motor performance.

We think that the presence of high-quality visual functions is necessary also at all stages of motor learning, when the quality level of space depth perception significantly influences this process. We assume that our research will continue mainly by enlarging the research group, thus our hypothesis can be generalized.

RECOMMENDATIONS FOR PRACTICE

In the early diagnosis of disorders of visual functions is made in children by ophthalmologists, appropriate medical therapy (visual rehabilitation) can be applied and some

disorders may be gradually relieved, or completely removed. At the same time, this specific examination may reveal higher than normal values of visual acuity and single binocular vision, which may be vital information in the process of decision-making for future sports and physical activity orientation of children.

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