

FORMATION OF 17-18 YRS AGE GIRL STUDENTS' VISUAL PERFORMANCE BY MEANS OF VISUAL TRAINING AT STAGE OF ADAPTATION TO LEARNING LOADS

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Abstract. *The purpose:* substantiation of health related training influence of basketball and volleyball elements on functional state of 1st year students' visual analyzers in period of adaptation to learning loads with expressed visual component. *Material:* in experiment 29 students of 17-18 year age without visual pathologies participated. Indicators of visual performance were determined by correction table of Tagayeva and processed by Weston methodic. Accommodative function was tested by method of mechanical proximetry. *Results:* the authors worked out and tested two programs of visual training. Influence of visual trainings on visual performance's main components (quickness, quality, integral indicators) was studied as well as eye's accommodative function (by dynamic of position of the nearest point of clear vision). *Conclusions:* Application of visual trainings at physical education classes permits to improve indicators of visual analyzer's performance as well as minimize negative influence of intensive learning loads on eye's accommodative function.

Key words: learning, eyesight, visual, training, performance, accommodation, myopia.

Introduction

Students' health and factors, which determine it, are subjects of many scientists' works [5, 9, 20, 21]. In these works it is stressed that factor of physical education is one of the most effective and efficient components of students' health protection [6, 13, 14]. Demand in correction of students' health by means of physical education is accentuated in recent works [5, 12, 16]. With it, trends to reduction of health indicators, owing to didactic factors of learning process's intensification, are noted.

Analysis of modern level of learning loads at higher educational establishments (HEE) points at significant increase of volumes of information to be mastered by students in conditions of noticeable time deficit [8]. It conditions great scope and tension of visual component of students' learning functioning (reading, written and graphic works, usage of computers and etc.) that, altogether, create risks of worsening of visual system's functional state. In the future: first at pre-nosological disorders and then – yep to eye diseases [20, 21].

Cause and effect relations between tensed learning functioning and visual disorders were determined in a number of scientific works [4, 17, 18]. Application of special physical exercises for prophylaxis and treatment of myopia was discussed in works by U.G. Bates [7], Ye.S. Avetisov [1], V.F. Bazarny [4], G.G. Demirchghian [11] et al.

Just pre-nosological (and pro-morbid) states of visual system, caused by excessive work, in first turn require related effect of prophylaxis-correction exercises. This is witnessed by data, received by S.A. Marchuk [15]. And on the contrary, reduced possibilities of health rehabilitation and treatment of visual system are noted as existing in physical education of special health groups' students, who have myopia [16].

Basing on tri-factor theory of myopia formation by E.S. Avetisov and theory of U.G. Bates, one of main factors of eye myopia is weakening (i.e. absence of training) of visual analyzer's muscular system. That is why idea of special visual training lens's ciliary muscle by A.I. Dashevskiy and E.S. Avetisov [2, 10] and eye muscles by U.G. Bates, M.D. Corbett [7] et al is in the basis of many methodic on prophylaxis and treatment of myopia [1, 2, 7, 11, 15]. But, with it data about influence of different physical exercises on muscular system of students' eyes and their visual system in general in period of adaptation for learning loads at HEE are quite insufficient [1].

Purpose, tasks of the work, material and methods

The purpose of the work was to study health related influence of specially selected physical exercises on visual analyzer's functional state of first year students in period of adaptation to learning loads with expressed visual component.

Material and methods of the research:

The research was conducted on the base of KSPU, named after V. Vinnichenko during 2013-2014 academic year. For participation in the research 29 girl students of 17-18 yrs. age from pedagogic and psychology faculty were selected on the base of last medical examination. All they related to main health group and had no visual pathologies.

For realization of our purpose and tasks we used the following methods: correction test on determination of visual performance by Weston methodic and correction table of N.T. Tagayeva. We determined indicators of accuracy and quickness of visual performance (VP), calculated integral indicators of visual performance (IIVP) Additionally, by method of mechanical proximetry we determined punctum procsimum - PP₁ as indicator of accommodative apparatus's ability for maximal visual tension.

Results of the researches

The conducted pedagogic observations (including timing) over scopes of students' visual loads and students' questioning during first semester showed that weekly academic load is 40 hours. Scope of everyday independent work was 3.5-4 (astronomical) hours. Thus, usual working day stipulated up to 12 hours of visual loads. In connection with such significant visual component of students' learning work especially interesting is the question about performance

of visual analyzer. Also it concerns its ability to endure the mentioned and obviously critical scope of visual work in conditions of organism's adaptation to new learning conditions without harm for health. It is known that excessive visual loads weaken eye's accommodative function and eye muscles. This aspect is regarded in theories of Avetistov-Bates as certain trigger of following chain of complexly acting factors: tension of durable visual work at close distance and bent for changing of sclera's shape from ball to oval. It results in development of myopia. Visual work is usually fulfilled in close field of vision that is accompanied by tension of eye's accommodation. It should also be noted that part of classes (practical classes, seminars) are conducted against the background of significant emotional stresses. In new conditions of learning and sharp deficit of motor functioning it can provoke distress and result in functional disorders. In this connection some scientist rather reasonably affirm that psycho-emotional stress can substantially reduce students' adaptation potential and condition appearing of visual disorders [8]. So, influence of learning loads' visual component on students' visual functions in initial period of study requires certain health related measures.

For experimental model of physical education class for first year students we selected exercises of "Basketball" and "Volleyball" sections. It was connected with the following: such elements of basketball as throws in basket and especially passes (like in volleyball as well) by character of visual apparatus's work are very close to special visual exercises. Such exercises are used in ophthalmology and in therapeutic physical culture for training of eye's muscular system. For example A.I. Dashevskiy and Yt.S. Avetisov improved ciliary muscles' workability with exercises on accommodative simulator. U.G. Bates and M. Corbett developed visual function by training and exercises on relaxation (palming) of eye's muscular system [1, 10]. Thus, idea about increasing of visual analyzer's performance is based on improvement of accommodative (internal) and muscular (external) eye's apparatuses with special physical exercises.

For conduct of pedagogic experiment at practical classes in physical culture we worked out and implemented two models of trainings, which by time budget were:

Model A (with elements of basketball) was realized during November-December and included:

- complex of general exercises in motion and at the spot (for activation of blood circulation system in general and muscular apparatus of healthy visual analyzer in particular) – 15%;
- dribbling the ball with right (left) hand with changing direction of movement (training of internal, i.e. ciliary muscles of healthy visual analyzer) – 15%;
- catching and passing of ball in different ways in pairs at the spot and in motion (training of ciliary and eye muscles)– 25%;
- penalty throws (training of ciliary muscles) – 30%;
- exercises for correction of posture and correct learning sitting (increase of supporting motor system's workability in conditions of durable influence of static component of students' learning work)– 15%;

Model B (with elements of volleyball) was used during long term adaptation to learning loads (February-March) and included the following means:

- complex of general exercises (GE) (in motion and at the spot) – 20%;
- Passing of ball by two hands from above – 15%;
- Passing of ball by two hands from below– 15%;
- Passing of ball in pairs by two hands from above or from below – 20%;
- Servicing of ball – 20%;
- exercises for correction of posture and learning sitting – 10%.

Schema of researches envisaged testing of visual analyzer's performance in period of students' long-term adaptation to learning loads. It permitted to reveal certain formation in dynamic of visual system's work before and after learning loads. Besides it made possible to study influence of physical culture classes on visual analyzer as per mentioned above models of visual training.

Table 1

Visual analyzer's performance of 17-18 yrs age girl students after different variants of learning work at the end of first semester (December) $M \pm m$

The tested	Levels of VP after first shift of academic classes (6 hrs)		Integral indicators of VP	VP levels after second shift of academic classes (6 hrs)		Integral indicators of VP	VP levels after visual training at physical culture classes, model A		Integral indicators of VP
	VP quality	VP quickness		VP quality	VP quickness		VP quality	VP quickness	
EG (n=29)	0.854± 0.021±	0.206± 0.009±	0.177± 0.01±	0.822± 0.036±	0.232± 0.012±	0.193± 0.014±	0.839± 0.025±	0.276± 0.014±	0.235± 0.013±

Notes: VP visual performance, EG experimental group.

Analysis of the received data (see table 1) shows that tension of visual analyzer's work has trend to increase by the end of day. For example, integral indicator of visual performance (VP) after learning in second shift increases by

9% ($t=0.13$; $p>0.05$). It happens, to large extent, at the account of reduction of visual work's quickness in comparison with first shift (by 12.62% ($t=1.73$; $p>0.05$) and certain weakening of visual work's quality by 3.75% ($t=0.76$; $p>0.05$). Such dynamic of VP integral indicators can be explained by revealed sharp intensification of visual component of students' learning work, connected with increase of visual work's scope. It requires appropriate level of visual system's functional fitness (in particular visual performance). For example, recognition of complex visual images (letters and figures) on one page of printed text requires fine differentiation of about 15.5 of complex by configuration black-white optical types.

Results, registered after visual training at the end of first stage of experiment (model A) were principally important. VP integral indicator substantially increased and became confidently different from received indicators of first and second shifts by 21.76-32.8% ($t=2.21-3.63$; $p<0.05\div 0.001$) accordingly. The received increment can be explained only by influence of experimental factors: health related influence on visual analyzer of model A exercises. At second stage of experiment we used training by model B. (see table 2).

Table 2

*Visual analyzer's performance of 17-18 yrs age girl students (March),
M±m*

The tested	Levels of VP after first shift of academic classes (6 hrs)		Integral indicators of VP	VP levels after second shift of academic classes (6 hrs)		Integral indicators of VP
	VP quality	VP quickness		VP quality	VP quickness	
EG (n=29)	0.835± 0.019±	0.233± 0.007±	0.196± 0.08±	0.885± 0.012±	0.294± 0.008±	0.262± 0.01±
CG (n=15)	0.815± 0.031±	0.211± 0.01±	0.174± 0.14±	0.704± 0.041±	0.263± 0.017±	0.183± 0.02±

Notes: EG experimental group, CG – control group

Control group of girl students attended traditional physical culture classes, in which also elements of basketball and volleyball were applied, but without appropriate accentuated load. Table 2 data show, that VP indicator, achieved by experimental group after model B trainings statistically do not differ from indicators of this group after academic classes. Indicators of visual work's quality differed by 6% ($t=1.79$; $p>0.05$), and integral indicator – by – 33.7%, but these differences were statistically insignificant ($t=0.81$; $p>0.05$). It witnesses about certain high stability of the tested VP indicators during working day, providing visual training is conducted.

Effectiveness of model B is also proved by comparison of VP of experimental and control groups. For example, in experimental group integral indicator confidently increased by 43.2% ($t=3.29$; $p<0.001$).

The determined tension of parameters of visual analyzer's performance required profound studying of eye accommodation of students in the researched period of learning. It was connected with the fact that visual component of students' work stipulates eye' working just in close field of vision. It is accompanied by the greatest tension of accommodation apparatus and external eye muscles. That is why it was important to test those functional indicators, which determine accommodation and external eye muscles' operation in dominating zone of students' visual work. One of such ophthalmic indicators is position of point of the most clear vision (punctum procsimum – PP₁).

Optical setting of eye to the nearest point of clear vision permits to determine ability of ciliary muscle and external eye muscle (main regulators of accommodation) to maximal momentary tension in natural (learning) conditions of visual analyzer's functioning. Besides, disordering of PP₁ point, after dozed visual work, permits to assess stability of dynamic refraction in this visual zone [2].

At the beginning of experiment position of the nearest point of clear vision in both groups met age standards of accommodation function's development (by Donders) and was 7.84±0.35 cm. And was statistically uniform ($p>0.05$).

In the course of first and second stages of experiment we tested two models of visual training, which resulted in the following:

Table 3

Position of the nearest point of clear vision (PP₁) at different stages of experiment M±m

Stage of experiment	Kind of visual training	Position of PP ₁ , cm	
		EG(n=29)	CG(n=16)
Ist stage (November-December)	Model A	8.05±0.20	8.64±0.31
	Model B	8.80±0.22	9.71±0.34

At the end of first stage of experiment position of PP₁ points increased in both groups and but in EG it was 3.21% ($t=0.53$; $p>0.05$), while in CG– 10.77% ($t=1.72$; $p>0.05$). That is why in intergroup indicators there appears difference, which was 6.83% ($t=1.59$; $p>0.05$). At the end of second stage of experiment (April, May) after application of model B in EG group trend to increase of PP₁ position remains in both groups. Though in EG it was, in respect to first stage, 9.3% ($t=2.53$; $p<0.05$), and in CG – 12.38% ($t=2.33$; $p<0.05$).

Analysis of all PP₁ points' positions during all experiment makes us to recognize negative influence of fixed scopes of visual learning loads in close field of vision on visual analyzer's accommodative function in both groups. But application of worked out visual trainings is rather effective barrier, which prevents from myopia among first year students at stage of adaptation to learning loads. Just accelerated rates of increasing of PP₁ position in CG at first and second stages of experiment point at progressing weakening of eye's accommodative function. It can be regarded as one of main factors of expansion of accommodative myopia among students.

Discussion

At the beginning of our work we hoped to receive data, which completely would prove effectiveness of worked out visual training models. Fundamental principles of theory of accommodative myopia (U.G. Bates [7], A.I. Dashevskiy [10], Ye.A. Avetisov [1, 2]) caused by weakening of eye's muscular system, were the basis for our assumptions.

We think that our purpose was achieved, though not completely, as far as determined in the course of experiment types of visual performance in all tested groups do not differ clearly by indicators of quality and quickness. But quick effect of health improving influence of visual trainings on dynamic of eye performance can be considered proved. Comparison of the received data with data of other authors [15, 16] witnesses that maximally expressed health related effect of different visual exercises and methodic is observed just at level of pre nosological and pre-morbid state of students' visual analyzers.

In our research we, for the first time, analyzed specificities of healthy visual performance by indicators of quickness, quality and integral indicator of 17-18 yrs age girl students in period of long term adaptation to visual component of learning work.

We revealed super-critical, actually not stipulated by organization of educational process scopes of visual loads. They are characteristic just for initial period of students' learning at HEE. It should also be noted that this fact creates certain difficulties for conduct of experiment. It does not permit completely control parity of visual learning loads in experimental and control groups. We admit that it could reflect in results of testing of some participants of experiment.

For the first time by dynamic of PP₁ distance increase we determined general negative trend to weakening of 1st year girl students' eye accommodative function. In period of adaptation to new conditions of learning this phenomenon shall be regarded as specific marker of appearing of eye myopia under influence of excessive visual work in close field of vision.

By results of the conducted experiment we can also think that functional affinity and effectiveness of selected for visual (accommodative) training exercises have been proved. They are exercises on ophthalmic stimulators, built on principles of "accommodation slacking".

Conclusions

Initial period of learning at HEE is characterized by critically high scopes of learning loads' visual component and it requires specially organized visual trainings.

Worked out on the base of basketball and volleyball elements models of visual trainings (as part of specialized physical education classes) showed expressed accommodative-training effect. It permits to minimize negative influence of excessive visual loads.

Integral indicator of visual performance and its components (quickness and quality of visual work) in EG illustrate certain stability in days of visual training, which confidently differ from indicators of control group.

Dynamic of PP₁ point's position during all experiment illustrate certain health related effect of accommodative function of EG girl students' visual analyzers.

The prospects of further researches imply working out of principles of students' visual training on the base of studying of regularities of quick and long terms adaptation to learning loads.

Acknowledgement

The research has been conducted in compliance with complex plan of SRW for 2014-2015 of KSPU, named after Volodymyr Vinnichenko in direction "Formation of students' positive adaptation to learning work by means of physical education".

Conflict interests

The authors declare they have no conflict interests.

References:

1. Avetisov E.S., Livado E.I., Kurpan Iu.I. *Fizkul'tura pri blizorukosti* [Physical education with myopia], Moscow, Soviet sport, 1993, 80 p. (in Russian)
2. Avetisov E.S. *Blizorukost'* [Myopia], Moscow, Medicine, 1986, 240 p. (in Russian)

3. Khripkova A.G., Antropova M.V. *Adaptaciia organizma uchashchikhsia k uchebnoj i fizicheskoj zagruzkam* [Adaptation of an organism of students to educational and physical loads], Moscow, Pedagogy, 1982, 240 p. (in Russian)
4. Bazarnyj V.F. *Zrenie u detej* [Eyesight in children], Novosibirsk, Science, 1991, 135 p. (in Russian)
5. Bashavec' N.A. Stan zakhvoriuvanosti suchasnoi students'koi molodi ta shliakhi jogo polipshennia [Sickness rate of modern youth and ways of its improvement]. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2011, vol.7, pp. 6-10. (in Ukrainian)
6. Belykh S.I., Health, physical education and physical development of students in historically and personally developing paradigm. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.5, pp. 7-12. <http://dx.doi.org/10.6084/m9.figshare.707091>
7. Bejts U.G., Korbett M.D. *Uluchshenie zreniia bez ochkov* [Better eyesight without glasses], Moscow, Air transportation, 1990, 160 p. (in Russian)
8. Bodrov V.A. *Informacionnyj stress* [Informational stress], Moscow, PER SE, 2000, 352 p. (in Russian)
9. Bojko D.V. Suchasnij stan ta perspektivni napriamki vdoskonalennia fizichnogo vikhovannia studentiv VNZ Ukraini III-IV rivniv akreditacii [Current status and future directions of improvement of students physical education of higher educational establishments of Ukraine III-IV accreditation levels]. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2012, vol.1, pp. 22-25. (in Ukrainian)
10. Dashevskij A.I. Lozhnaia blizorukost' [False myopia], Moscow, Medicine, 1973, 152 p. (in Russian)
11. Demirchoghlian G.G. *Kak sokhranit' i uluchshit' zrenie* [How to maintain and improve vision], Donetsk, Stalker, 1997, 320 p. (in Russian)
12. Kashuba V.O., Futornij S.M., Andrieieva O.V. Ociniuvannia ta analiz skladovikh zdorovogo sposobu zhittia students'koi molodi [Evaluation and analysis of the components of a healthy lifestyle of students]. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2012, vol.7, pp. 59-65. (in Ukrainian)
13. Kolumbet A.N., Features of organization and maintenance of physical education of students of higher pedagogical educational establishments. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.5, pp. 27-32. <http://dx.doi.org/10.6084/m9.figshare.707095>
14. Konova L.A., Physical improvement and its impact on the health of students. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.5, pp. 33-36. <http://dx.doi.org/10.6084/m9.figshare.707096>
15. Marchuk S.A. *Profilaktika narushenij zreniia studentov pedagogicheskikh vuzov sredstvami ozdorovitel'no-korrekcionnoj gimnastiki. Cand. Diss.* [Prevention of violations of pedagogical students means recreational and correctional gymnastics. Cand. Diss.], Ekaterinburg, 2004, 24 p. (in Russian)
16. Pustoliakova L.M., Makaieva N.A. Fizichne vikhovannia studentiv VNZ, vidnesenikh za stanom zdorov'ia do special'noi medicnoi grupi z diagnozom "miopiia" [Physical education of students of higher educational establishments classified as special medical care to the group diagnosed with "myopia"]. *Fizichna kul'tura i sport*, 2014, vol.3(44), pp. 316-319. (in Ukrainian)
17. Futorni S.M., Ways to improve the organization of physical education students in higher education. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.12, pp. 94-100. <http://dx.doi.org/10.6084/m9.figshare.880635>
18. Bondarenko S. 5-6 Year old Children visual efficiency development in the period of school loading adaptation by means of visual exercises. *The journal of education*. 2014, vol.106, pp. 149-156.
19. Dolezanova V., Mottlava D. Relation between myopia and intelligence. *Czech and Slovak Ophthalmology*, 1995, vol.4, pp. 235-239.
20. King-Chung D., Ki Fung Ving, XingSuxuan, Hagger M.S. Myopia prevention, near work, and visual, acuity of college students: integrating the theory of planned behavior and self determination theory. *The journal of Behavioral Medicine*, 2014, vol.37, no.3, pp. 369-380.
21. Shiny G., Biju B. J. Study on the prevalence and underlying factors of myopia among the students of a medical college in Kerala. *International journal of Medical Research Health Science*, 2014, vol.3(2), pp.330-337.

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Cite this article as: Bondarenko S.V., Darzinska N.O., Sidilo
L.V. Formation of 17-18 yrs age girl students' visual performance
by means of visual training at stage of adaptation to learning
loads. Pedagogics, psychology, medical-biological problems of
physical training and sports, 2015, vol.4, pp. 10-15. <http://dx.doi.org/10.15561/18189172.2015.0402>

The electronic version of this article is the complete one and can be found online
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Received: 18.03.2015

Accepted: 15.04.2015; Published: 20.04.2015