The application of the lower view lock to improve posture and develop walking abilities in individuals with cerebral palsy

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Abstract

Objective of the study was to assess the impact of employing low-vision obstructions on the development of ambulation abilities and posture improvement in individuals with cerebral palsy.

Methods and structure of the study. The research was conducted at the Center for Adaptive Physical Culture of Petrozavodsk State University over an eight-month period. The experimental group comprised ten individuals aged between 12 and 23, all of whom had been diagnosed with cerebral palsy.

During the study, the participants engaged in adaptive physical education sessions, which involved a combination of traditional exercises in an upright position with movements and a more advanced approach — the lower field of peripheral vision was obscured using dribbling glasses, similar to those used in basketball.

Results and conclusions. The evaluation of the outcomes at the conclusion of the trial revealed that the participants were able to decrease the time required to traverse a straight line of 5 meters by an average of 57%. Nine out of ten participants enhanced their accuracy in measuring distances, completely eliminating any spikes. The duration of maintaining balance in the Romberg test increased by more than twofold. The findings of the investigation can be applied in the development and improvement of walking for children with cerebral palsy.

Keywords: *walking skill, visual analyzer, coordination, cerebral palsy, adaptive physical education.*

Introduction. Despite some differences in the symptoms of the disease, the walking stereotype in children with cerebral palsy (hereinafter CP) with spastic diplegia syndrome has typical features [6].

The disorders are manifested in a decrease in stability when walking; along with this, there is a rephasing within the support phase, the time of support on the heel and the entire foot decreases and the time of support on its forefoot increases [7].

Children with musculoskeletal disorders cannot, as a rule, stably maintain an upright position. In the worst case, this does not allow them to sit, stand and walk, and in the case of maintaining the vertical, it affects the correct pattern of taking poses and gait, as well as the successful development of motor skills during rehabilitation classes [3].

Impaired support ability, manifested in the distribution of body weight over the entire area of the feet of both legs, the transfer of support to the anterior, posterior, lateral and medial parts of the feet while standing, walking, running, directly affects the state of posture. Pathological changes in the lower extremities reduce the cushioning of the feet and increase the vibration impact on the spine [7].

Walking in children with cerebral palsy is formed on the basis of the already formed vertical position of the head and body and the ability to maintain a standing position, leaning on each leg [9].

Straightening reactions in cerebral palsy develop incorrectly due to unquenched and intensifying tonic reflexes. The lack of formation of the righting reflexes affects posture - lordosis does not form in the cervical and lumbar regions, and thoracic kyphosis is excessively pronounced.

The visual system, along with the somatosensory and vestibular systems, is one of the leading components of postural control and balance maintenance [2]. The ability to maintain balance is one of the main

requirements for the formation of walking skills. Accordingly, the visual analyzer plays an important role in this process, taking an active part in maintaining balance - with a sharp change in position and the risk of falling, stability is maintained due to the visual and vestibular receptors [4]. Lower visual field defect is a disorder observed in cerebral palsy due to dysfunction of the dorsal stream.

The interaction of sensory systems, such as proprioceptive, vestibular and visual, is the basis of complex coordination activity. The sense organs play an important role in the development and manifestation of coordination abilities, since it is necessary to recognize the surrounding space in the process of motor mobility.

The study by K. Onerge, H. Evrendilek, R. Sert, N.E. Akalan, F. Bilgili showed that with a limitation of the vertical lower visual field in healthy people, the support area during walking significantly increases [10].

According to other studies [1, 5], when visual control is disabled, the efficiency of movement performance decreases, and an increase in the oscillation of the center of gravity is observed. In the absence of special training, the visual analyzer has a strong influence on maintaining balance and controlling one's own movements. Therefore, the limitation of the visual analyzer is a complicated condition for performing habitual actions and can be used as a means of training coordination.

Objective of the study was to assess the impact of employing low-vision obstructions on the development of ambulation abilities and posture improvement in individuals with cerebral palsy.

Methods and structure of the study. The research was conducted at the Center for Adaptive Physical Culture of Petrozavodsk State University for 8 months. The experimental group consisted of 10 people aged 12-23 years with a diagnosis of cerebral palsy (3 people with spastic diplegia, 7 with spastic tetraparesis), the motor functions of all participants correspond to the second - third level according to the GMFCS classification.

Throughout the study, in adaptive physical education classes, traditional exercises in a vertical position alternated with a more complex method - the lower field of peripheral vision was blocked using dribbling glasses used in basketball. A simple Romberg test and independent overcoming of a five-meter distance limited in width to 30 cm with measurement of speed and number of steps were chosen as control exercises. One subject moved with the help of Nordic walking poles. Comparative values were determined using photo fixation, the angle of inclination of the body and head were measured using the Physio Master program. At the ascertaining stage, control exercises with alternating blocking of the lower view and without it (a total of 6 series) were performed for three weeks. To avoid possible errors caused by fatigue of the trainees, the exercises were performed at the beginning of the lesson.

The average value of overcoming a straight 5 m in glasses with blocking of the lower view was 34.6 seconds with the number of steps 1.6 times, without glasses - 53.6 seconds with the number of steps 4.6 times; the time of performing the Romberg test with glasses and without, was 36 and 22 seconds, respectively.

Thus, with blocking of the lower view of vision, the exercises are performed more successfully, possibly due to the fact that the head is raised and the gaze is directed forward. It was decided to include this method when performing exercises in a vertical position and with movements in the training program and to determine its effectiveness. The program included cyclic exercises aimed at developing endurance, passing an obstacle course, strength exercises aimed at strengthening the extensor muscles of the upper and lower extremities, exercises for statokinetic stability and joint gymnastics.

Results of the study and discussion. Analysis of the results at the final stage of the experiment showed that the participants managed to reduce the time to overcome a straight 5 m by an average of 57%, 9 out of 10 participants improved the accuracy of the distance to the complete elimination of step-overs. The balance time in the Romberg test increased more than 2 times (Table 1).

Table 1. Results of the Romberg test (mean value, s)

Practice attempts (without glasses/ with glasses)	Without glasses (s)	In glasses
1 week	22	36
2 week	30	40
Final testing	54	73

Comparison of the angle values between the vertical axis and the body in glasses with and without blocking the lower view showed minor differences: from 3 to 5 degrees. The difference in the position of the head relative to the vertical is more significant, since the use of glasses for dribbling limits the lower field of view, which is why participants are forced to direct

Table 2. Head tilt angle when walking (degrees)

Review	1	2	3	4	5	6	7	8	9	10
Head tilt without glasses	56	55	33	31	23	27	34	19	28	49
Head tilt with glasses	41	38	27	22	19	20	33	15	11	35

their gaze forward and upward and concentrate on the situation in front (Table 2). This leads to a decrease in the forward head tilt angle relative to the vertical axis by 7-17 degrees.

During the observations, it was found that some participants experienced an increase in the stability and steadiness of the body during unsupported walking, and the stride length of the weaker leg increased. Some participants noted a particular ease in performing exercises without limiting peripheral vision after training with dribbling glasses.

C**onclusions.** The results obtained in the course of the study allow us to propose the use of blocking the lower view in the process of correcting the walking skill as an effective way to perform a motor action. The use of non-standard equipment makes it possible to expand the range of means used in classes with children diagnosed with cerebral palsy.

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