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The effectiveness of a mobility and orientation training program on static and dynamic balance skills of children with visual impairment

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ABSTRACT

This study aimed to evaluate the effectiveness of orientation and mobility training on static and dynamic balance skills of 7 to 11 year old boys with visual impairment. This semi-experimental study is with pre- and post- test control group and the follow up. Thirty students with visual impairments were randomly assigned to two experimental and control groups (15 students in each group). Oseretsky Motor Developmental test was performed on both groups as pre-test. The experimental group had received mobility and orientation training program for 15 sessions and 45 minutes for each session. Immediately after completion of the intervention, Lincoln Oseretsky was performed on both groups as post-test again. Multivariate analysis of covariance was used for data analysis. This test was also performed 2 months after the intervention as a follow up to ensuring that the impact of the training is sustained. The pre-test results showed no significant difference between the experimental and control groups, however, the experimental group students' scores in the post-test and follow-up scores were significantly different after the training ($p< 0/001$). It seems that orientation and mobility training program can improve static and dynamic balance skills of children with visual impairment. As a result, implementation of this method to improve the balance of this group of children is recommended.
KEY WORDS: Mobility and orientation, static and dynamic balance, visual impairment, children

1. INTRODUCTION

Visual impairment and blindness are among the most common disabilities in adults affecting daily movement and activities [1]. The blind person is derived from the first and the most useful sense of human beings which is visual perception. Although other senses provide valuable information, visual perception presents the most reliable and detailed information about the environment to anybody [2]. Visual perception which provides rich information for a person's movement, has a special importance in motion control and balance and is often more significant than the other natural senses [3]. Any damage to the visual receptors causes problems in spatial orientation of children, balance and motion skills. In the primary school, special attention should be paid to the children who their motional activities are decreased because of getting used to low performance of vision; it is because this period of life is one the most effective periods for acclimatizing to physical exercises, correct statures and improving physical capabilities such as motion coordination and spatial perceptions [4]. Balance is an essential factor for the blind people that help to create spatial integration in them [5]. Balance is defined as the process of keeping center of gravity of the body in the supporting surface area. All the routine activities are needed to control the balance in the static and dynamicpositions [6]. Balance can be static or dynamic. Static balance is defined as the ability to keep the supporting surface with minimum movement and dynamic balance is defined as the ability to perform an activity or task while maintaining the stable situation [7]. Controlling the balance of a human being depends on the integrity of informants from atrial, visual and sensory-body systems. When one of the involved systems in stature control decreases and loses its activity, a drop in performance of other stature control mechanism occurs [8]. It should be said that oscillations of the body is achieved through muscular contractions and with the sensory information in central nervous system. These receptors consist of visual receptors in the eyes, auditory receptors in the ears and cutaneous receptors in the body surface. According to the theory of sensory compensation, auditory receptors have a great importance in these children, because the auditory drivers provide the possibility of spatial orientation, environmental perception and maintaining balance through sound along with affecting the auditory receptors in blind children [9]. Given the fact that the dynamic balance is a sample motion response, it depends on the integration of visual, auditory and motion sensor system stimulants. In addition to the visual perception, motion

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perception and auditory perception also show that the relative position of the organs and body parts, therefore, body motion is a useful factor in enhancing the balance while performing physical exercises [10].

Various studies have shown that the elimination of visual factor in sighted people causes weakness in balance control; therefore, blind people have additional problems in balance control which is the key component of plenty of activities [11]. The results of a research by Aidog et al. show that blind people who play goal ball for 1-2 days in a week have better balance than the inactive people and those who exercise have better balance than the non-athletes [12]. Philipa et al (2012) investigated the impact of muscular-nervous exercises on balance test in young female athletes. They show that these exercises have a significant impact on balance in aspects of posterior-outside and posterior-inside of the experimental group [13]. Moreover, Cahell (2009) studied the effect of one training course of core exercises on balance test in young healthy people. The results show that for most of the test directions, the maximum access distance in exercise group improves in comparison to control group [14]. Therefore, we attempt to use a series of motion skills in form of movement and motion training in this study to keep and enhance the static and dynamic balance of children with visual impairment.

2. METHOD

This research is a semi-experimental study with pre-test and post-test design. The purpose of this study is to determine the impact of mobility and orientation training on enhancement of static and dynamic balance of children with visual impairment. The statistical population consists of all the children between the age of 7 and 11 with visual impairment in exceptional center of Shahid Mohebi in the city of Tehran during the academic year of 2012-2013. In this research, we used the available sampling method based on the purpose. The number of samples in this study was 15 in each group and a total number of 30 children between 7 and 11 years old with visual impairment considering random input and output criteria in experiment and control groups. Input criteria include children having the minimum score (0-1) in the static and dynamic Lincoln-Oserestsky pretest. These children with severe visual impairment were between 7 and 11 years old having normal IQ (90-110) inserted in the child's records. Output criteria include other sensory impairments (auditory, etc) or physical disabilities being participated in a program similar to the training program used in this study and in the absence of training sessions (more than 2 sessions). Later on, the parents and students were informed and their written consent for participating in this research was obtained with regard to ethical concerns and stating the research objectives. Moreover, we assured the students that they can leave the research any time and there is no obligation to take part in this study. At the same time, we reassured that the name, identity and information of the participants would remain confidential and the final results will be shared with other people and institutes with the consent of all the participants in this group.

Growth scale of Lincoln-Oserestsky is one of the tools being used in this research. This scale is designed to evaluate movement ability of children between 5 to 14 years old and is performed individually. It takes about 1.5 hours and has 36 materials in 6 micro scale including general static coordination, general dynamic coordination, manual dynamic coordination, movement speed, concurrent-symmetric voluntary movements, and no concurrent-asymmetric voluntary movements [15]. Micro tests of this scale are scored between zero and three. The reliability coefficient of this test using breaking method is from 0.51 to 0.93 [16]. In order to train the intervening group, we used training protocol with the purpose of enhancing the balance of children with visual impairment. This program was adapted from the book "Orientation and Movement Techniques" [17], the book "Visual Impairment Handbook" [18] and a research with the title of "Movement and orientation program in public schools" [19]. After selecting the subjects based on school records and input and output criteria, we performed the Lincoln-Oserestsky pretest and then the subjects were divided into two groups including experiment group and control group. Training program was performed for the experiment group in 15 sessions with 45 minutes' duration and was held 3 times a week. Subjects of the control group solely received the usual class training in the course of study. After the completion of the last session, the Lincoln-Oserestsky test was performed on both groups as a post-test. Two months after the implementation of the research, the above mentioned test was performed on the groups in order to assure the consistency of the training effects. In order to analyze the data, we used the multi variable covariance analysis method with the SPSS software package.

2.1 Content of Training Sessions

First session: Getting familiar with children and explaining movement and orientation program (training protocol) in form of simple sentences through speech and question and answer session.

Second session: Explaining the benefits of training program and its application in daily life and familiarizing children with spatial orientation concepts such as left, right, up and down in order to help them enhance their balance.

Third session: Training children in the calming skills and explaining the negative effects of muscular tensions on the movement skills and balance maintenance.

Fourth session: How to use mental exercise along with physical exercise in order to enhance the static and dynamic balance through group and individual training using motion examples in daily life such as running, standing, walking, etc.

Fifth to fourteenth session: Practical exercises related to keeping balance such as moving from one place to another without the help of a cane, moving up and down the stairs, learning the correct form of sitting on a chair, holding one hand and one leg in the air simultaneously, keep moving in a straight line and intended path, enabling the person to determine the intended place to go and reaching there, selecting the directions (vertical and parallel movement),and explaining the details orally.

Last session: Reviewing the previous exercises.

3. FINDINGS

The groups consisted of 30 boys suffering from visual impairment with the average age of 9.26±1.27 and age range of 7 to 11 years old. As Table 1 shows, the average age in experiment group and control group does differ in the pretest.

Having the effect of pretest controlled, the results from comparing post-test and follow up static and dynamic balance component in both groups indicate that after participating in the movement and orientation training sessions, the scores of these two components in the children who took part in the experiment group was significantly higher than those who were in the control group and they maintained this increase two month after the test Table (2).

Table 1: Comparing the average and standard deviation of static and dynamic balance scores in pretest, post-test and follow-up phases in experiment group and control group

Significance	Follow Up	Post Test	Pre Test	Group	Research Variable
P	Average Standard ±) (Deviation	Average Standard ±) (Deviation	Average Standard ±) (Deviation		
001/0>	2/83± 13/80	3/05±14/26	2/18±10/26	Experiment	Static Balance
	1/99±11/40	1/38±10/93	68/1±10/13	Control	
	1/71±13/33	1/54±14/40	1/62±10/06	Experiment	Dynamic Balance
	1/90±11/26	1/77±11/00	1/39±10/33	Control	

Table 2: Comparing the component score of static and dynamic balance scores in pretest, post-test and follow-up phases in the two groups with controlling the effect of pretest

Statistical Power	Effect Coefficient	P-value	F	Research Variable	Test
0/944	0/385	0/001	77/13	Static Balance	**Post Test**
0/999	0/558	0/000	74/27	Dynamic Balance	
0/567	0/184	0/037	95/4	Static Balance	**Follow Up**
0/633	0/208	0/025	78/5	Dynamic Balance	

4. DISCUSSION AND CONCLUSION

This research indicates the positive effect of movement and orientation training on enhancing the static and dynamic balance of children with visual impairment. This enhancement continues two month after the training. The results of this study are in alignment with previous studies such as McKisty [20], Philipa et al. [13], Aiduge et al. [12] and Ahmadi Barati [10].

In explaining these findings, there is an argument that the core part of body can be considered as a muscular belt in the center of motion chain which is the stabilizer for the spinal cord and body. Furthermore, due to the fact that the central beginner of all body part moments is considered as power base, the strength and perseverance of the muscles of this area allows the system to transfer the force in an appropriate way by mechanical stabilizing of the spinal cord [21]. The exercises for the core part of the body increase the strength, perseverance, controlling of internal pressure of the stomach and muscular control and affect the ability of body to keep its balance in various static and dynamic movements [20]. In this program, we have attempted to improve the center of gravity of the body to help people who are suffering from visual impairment to enhance their static and dynamic balance. McKisky investigated the effects of exercises for the core part of body on keeping balance and muscular perseverance of body. The results show that the training programs for the core part of body can have positive effects on maintaining the balance [22]. Aide et al. evaluated the dynamic

balance of 20 blind goal ball players, 20 inactive blinds and 20 healthy people by using Bidox measurement equipment. Dynamic balance in three general directions including front, posterior and input-output was evaluated and the test results from blind people and sighted people differ significantly. Moreover, the balance of goal ball players was higher than inactive blind people and the results show that the blind people who play 1 to 2 days a week, have higher input-output consistency than the inactive healthy people [12]. Ahmadi Barati et al. have conducted a research to compare the effects of physical, mental and physical-mental exercises on the balance capability of blind students between 7 to 12 years old. Their sample consists of 30 people with the training protocol. The study lasted for 8 weeks with two sessions in each week and each session lasted for between 45 to 60 minutes. They concluded that there is no significant difference between the groups in the static balance, however, only the mixed training method led to development of dynamic balance capability in the dynamic balance.

These findings were explained in the way that nonexistence of significant difference in the static balance variable among the three groups shows the compensating and reforming mechanisms, while the mixed method of mental and physical exercises has better results in complex activities. The results of that study and our study on significance of static balance may be caused by different kinds of exercises [10]. However it should be considered that the current study is limited to boys with visual impairment from 7 to 11 years old and the results cannot be extended to girls with visual impairments or other age groups. It is necessary to investigate the effects of exercise used in this study on other motion coordination capabilities for blind children or visually impaired children. We suggest that other studies should be conducted on other groups of students with regard to gender variable. Furthermore, other intervening methods based on modern technologies (equipment and computer) should be studied. As a practical proposition, training package should be provided to the therapists, teachers, trainers and parents so that they can promote the motion skills of children.

The results of this study show that using effective motion exercises related to core part of body can enhance the static and dynamic balance of children with visual impairment and it is a segment of their motion readiness. All the participating children in this research and authorities of Shahid Mohebi School in Tehran province are thanked for their collaboration in the study.

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