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The effect of vestibular stimulation on dynamic balance in mentally retarded children

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Abstract:

Objectives: *Mentally retarded children perform poorly in balance. The purpose of this study was to examine the effect of vestibular stimulation on dynamic balance in mentally retarded children.*

Materials and methods: *12 mentally retarded children of BorujerdAheia girl's exceptional school were selected based on inclusion criteria and they were randomly divided into two groups of 6: experimental and control. To measure dynamic balance, Heel-To-Toe test was used in pre-test and post-test. The experimental group received a 35-min vestibular stimulation, two times a week for 6 weeks. Independent T-test and dependent t-test were used to analyze the data using SPSS software version 16 and a significant level of 5% was considered.*

Results: *After 6 weeks of vestibular stimulation interventions in the experimental group, the results showed that the balance score in the experimental group was greater than the control group, which indicates a positive effect of Vestibular stimulation on the balance of mentally retarded children. But this increase was not statistically significant.*

***Conclusion**: In order to examine the effect of vestibular stimulations more precisely, similar studies need to be conducted with a more accurate measurement tool, larger samples of both sexes and more exposure time of these stimulation.*

Key words: Vestibular Stimulations, Dynamic Balance, Mentally Retarded Children.

INTRODUCTION:

With regard to the natural distribution of the population, the prevalence of mental retardation is expected to be about one to three percent, mostly mild to moderate mental retardation. 1. (Abbaspourany, Shariatzadeh, Lotfi, Naghavi, Hoseiny 2016 & Fernhall, Kenneth 2001)

Researchers agree that motor performance scores of the mentally retarded people are lower than their non-disabled peers. These studies also show that as the severity of mental retardation rises, impairment associated with the motor performance also aggravates. (Eichstaed , Lavay. 1999).

Mild and severe mental retardation children have poor performance in balance. (Venetsanou , Kambas. 2011)

Balance is one of the basic needs for routine activities and plays an important role in static and dynamic activities as well as in athletic skills. (Musavi , Ghasemi , Faramarzi. 2009).

Some researchers believe that after 11 years of age, balance does not grow much and the peak in balance growth is up to this age; however, others believe that growth in balance will continue until the age of 14.(Gholamisultanabadi. 2002).

Many organs and centers in the body work together, interact and help maintain a person's balance in different situations and during routine activities such as walking, jumping and running. The vestibular apparatus, in collaboration with the visual system and proprioception, plays an important role in maintaining the balance of living creatures. (Lotfi, Zamiriabdollahi, Javanbakht, Delphi, Sheikhzadeh, Ahmadi. 2015).

The vestibular apparatus in the inner ear acts as the center of balance (equilibrium); consequently, it is recommended for these children to work out, bend body in different directions and angles, and do rotational motions.These exercises help children learn how to improve their body stability and how to recover their balance.(Werner, Rini. 1997).

Since vestibular system receptors are of two types,one for angled motion and the other for linear and gravity motions, Vestibular stimulation can also be categorized accordingly. (Zeynalzadeh. 2010)

The necessity of this research is to find an appropriate solution for raising the balance of performance in this group of children. In this research, the effect of vestibular stimulations on the dynamic balance of mentally retarded children has been investigated.

RESEARCH METHODOLOGY:

The present research is applied in terms of purpose and it is quasi-experimental in terms of the nature of implementation. The research plan was implemented through pre-test and post-test in both control and experimental groups. The study population includes the girls at Eheia special school of mentally retarded children in Borujerd, 12 of which were selected. Inclusion criteria: students with intellectual disabilities studying "with an IQ of 50 to 70" using the Wechsler Intelligence Test previously performed by the tester of school of intelligence at school. The age range of 8 to 11 years, complete physical and mental health, lack of skeletal anomalies, lack of flat feet and early orthopedic injuries and lesions (fracture, Joint dislocation and subluxation) in the lower limbs, lack of genetic problems such as Down syndrome and the lack of behavioral disorders such as hyperactivity. Exclusion criteria:

Lack of cooperation during the test or vestibular stimulation intervening time, Non-attendance in medical sessions, in 2 consecutive sessions and 3 sessions in total number of meetings, parents'/teacher' discontent. Place of research was Occupational Therapy of the Eheia School (researcher's work place) and time of the research was April and May 2017).

Research process started with gathering information on height, weight and age of the students and 12 children were selected randomly and were divided into 2 groups of 6 control and experimental. After providing necessary explanations about the method of doing the test, required pre-tests were carried out. The experimental group received a 35-min vestibular stimulation, two times a week for 6 weeks using existing equipment at the department of occupational therapy school in common practices in occupational therapy clinics and in accordance with the configured protocol. Then, the post-test was performed from both groups. To carry out these stimulations, the rotational and linear motions (anterior-posterior, lateral, ascending and descending motions) in different positions (Standing, kneeling, sitting) were used. These stimulations began with linear motions and ended with rotational motions that were performed using tools such as trampoline, occupational therapy swing, C.P (cerebral palsy) ball, twist boardand tilt board. Stimulations in each position were repeated several times in short periods, the duration of each stimulus in linear motions was at least 1 minute and maximum 2 or 3 minutes, in rotational motions of at least 10 rounds (20 seconds), and the maximum in the case of endurance, 15 rotations to one side and after a 10-second stop, the same number of rotations turned opposite.

To assess dynamic balance, heel-toe test (Heel-To-Toe Dynamic Balance Test), (r=0.91) was used. This test evaluates the subject's ability to walk in a straight line from heel to toe. This test is conducted by asking the subject to take 15 heel to toe steps in a straight line. The maximum score of the subject is

15. If the subject is deflected from the path before completing 15 steps, the test stops and the number of steps is recorded (as a record). This test is performed 2 times by the subject, and the best score is recorded for the subject. (Lahtinen. 1986 . 2007).

The Kolmogorov-Smirnov test was used to examine the normality distribution of data. Dependent and independent t-tests were used to analyze the data using SPSS16 software at a significant level of 0.05.

RESULTS:

The average and the standard deviation of subjects' demographic characteristics including height, weight and age in both control and experiment groups are represented in table 1.
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Table 1. General characteristics of subjects

Groups	**N**	Age (year)	Height(cm)	Weight (kg)
1.Experimental M±SD	6	9.75±.98	134±7.96	29.50±10.70
2. Control M±SD	6	9.58±.82	129±9.95	31.83±8.75

M±SD : mean ± standard deviation

Initially, it was found that the variables of the present research were normal using Kolmogorov-Smirnov test. Therefore, parametric statistics were used to test the research hypotheses. Data were analyzed using independent t-test and dependent t-test and their data were summarized in Tables 2 and 3. The significance level was considered as 5%.

Table 2. Paired Samples T Test

Groups	N	Pre-test M±SD	Post-test M±SD	Mean Difference	T	Sig
1.Experimental M±SD	6	10.00± 5.36	13.50±2.81	-3.50	-2.267	0.073
2. Control M±SD	6	8.00±4.00	9.00± 4.33	-1.00	-1.074	0.332

$p<.05$, M±SD : mean ± standard deviation

As seen in Table 2, the pre-test and post-test differences are negative in both groups, that is, the results of the post-tests are accompanied by an increase. This amount is (-3.50) in the test group and (-1.00)in the control group. So, as it can be seen, these differences are not significant in neither group according to T- value.

Table 3. Independent Samples T Test

Position	DF	Mean Difference Pre-post Test ±SD	T	Sig
1. Experimental M±SD.	10	-3.50 ±3.78	-1.387	0 .196
2. Control M±SD	10	-1.00±2.28		

p<.05, M±SD : mean ± standard deviation

In Table 3, by comparing the difference between the pre-test and post-test means of the two groups with independent t-test as it is seen, there is no significant effect with regard to the obtained T-value (-1.387) and the significant level (0.196).

DISCUSSION AND CONCLUSION:

The results of the pre-test and post-test differences between the two experimental groups (-3.50) and control (-1.00) in Table 2 show that the results of both groups in the post-test were accompanied by an increase. But this increase is higher in the experimental group, which can be said to be due to a 6-week intervention of vestibular stimulation. But, in order to know whether this increase is statistically significant or not, dependent t-test was used whose value is Sig = / 073 in the experimental group, that is not meaningful.

Also, by comparing the results of the mean difference between the pre-test and post-test between the two groups, using independent t-test, which is shown in Table 3, according to the t-value (-1.387) and the observed significant level (0.196), these differences are not statistically significant. The results show that the experimental group shows a better balance performance than control group, and Vestibular stimulation have positive effect on the experimental group, but this increase is not statistically significant. The reasons for this can be attributed to various constraints of the researcher, such as sample size selection, limited exposure time to Vestibular stimulation, and not assessing/using precise and advanced measurement tools. Therefore, it is recommended that future researchers investigate the effects of these stimulations during longer exposure time and in groups of larger sample sizes of both sexes, and use a more accurate and advanced measurement tool to achieve more accurate results.

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