

Effectiveness of sensory integration method on improving children's attention

With attention-deficit and hyperactivity disorder

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Abstract— The present study was implemented to investigate the effectiveness of sensory integration method on improving attention in children with attention-deficit/hyperactivity disorder (ADHD). The study population included all 7-11 years old students with attention-deficit and hyperactivity disorder in primary schools of Mashhad. They were enrolled in school year 2013-2014. According to test criteria, 24 students with attention-deficit and hyperactivity disorder were selected by sampling method and randomly assigned to two experimental and control groups. The study was quasi-experimental research that has been done as interventional. The research design was pretest-posttest with control group. Tools used in this study were Swanson, Nolan and Pelham (2001) grading scale, Continuous Performance Test (Rozvold & et al, 1956) and Toulouse-Pieron Scale (1986). Dependent t-test results showed that attention in experimental group after intervention increased significantly compared to before intervention. In control group, these results were not statistically significant. But the results of the multivariate analysis of covariance revealed that in post-test two groups have not significant differences in attention and impulsivity.

The results indicated that performance of students' attention with ADHD increased by activities based on sensory integration approach. Also, the impulsivity of these children reduced, but these changes are not significant.

Index Terms— Attention-Deficit and Hyperactivity Disorder, Attention, Sensory Integration Approach.

1 INTRODUCTION

ADHD is one of the most common neurological- evolutionary disorders in childhood that is known by three characteristics of negligence, hyperactivity and impulsivity (Ambuabunos, Ofovwe & Ibadin, 2011). This disorder is a syndrome which begins from childhood and is known with abnormal levels of attention and movements control. These symptoms often interfere with everyday activities of children; hence those who are suffering from this disorder generally have a small attention scope and easily get a distraction. Moreover, failure in motor control makes them more vibrant than other peers and so-called they are not being relaxed. Some of these children have impairment in spatial-visual processing which is influential factor in attention. In general, ADHD children have significant defects in relation to fine motor skills, balance and stability (Rief, 2008). Motor skills are considered essential for maintaining attention, because if a person is able to have control and stability on his body he will be able to focus on a task. Gross and fine motor skills largely depend on child's integrity

and early sensory experiences (Kurtz, 2003). As child acts better in process of sensory information received from the environment and from his body, he will be more successful in taking the next steps and progress towards psychomotor skills (Fowler, 2007). A normal child is mainly received and integrated various sensory inputs, especially vestibular sense, proprioceptive and tactile sense from the environment within a few years of early life. Processing and integration of these sensory inputs and engage these senses with visual and auditory senses will cause some level of motor skills. Lack of sensory integration has been considered as a key diagnostic in relation to children with developmental problems, particularly attention-deficit and hyperactivity disorder. These children get different kinds of information due to differences in sensory processing. They also are in trouble in school, home and their social relationships.

Disorder in attention is influenced all matters of life and education and caused several failures for children (Afrooz, 2009). Even mild deficiencies in attention may be making difficult or even impossible doing some everyday activities for a person. Prevalence of this disorder has been reported in various cities between 3 to 13% (Shahim & et al, 2010). According to this that cognitive functions, memory, learning and behavior are strongly dependent on attention mechanisms; even minor defects in attention can significantly jeopardize their learning. Thus, it seems necessary to strengthen the attention in these children.

Since there are findings that show a motor general growth can help children have more concentration, working on motor skills can also help children with attention-deficit and hyperactivity disorder to improve their skills. Lufi & Gii (2008) ex-

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amined the effects of physical exercises on removing attention deficit in children with ADHD. They found that these exercises were effective on gross motor skills, balance and perceptual skills of these children in addition to effectiveness of attention deficit.

However, most studies conducted in rehabilitation of hyperactive children were drug therapy; sensory integration interventions have received little consideration. While regarding the high need of these children in the field of rehabilitation, movement importance and sensory-motor interventions in attention deficit, sensory integration interventions on hyperactive children are felt as a vacuum in our country.

2 RESEARCH METHOD

This study is quasi-experimental research. Research population consisted of all students with attention-deficit/ hyperactivity disorder in elementary school ages 7-11 years old, in Mashhad schools. They are studying in the school year of 2013-2014. 24 students were selected by available sampling method and randomly divided into experimental and control groups. Thus, students who had more attention problems were screened by helping teachers of three schools and by implementing Swanson, Nolan & Pelham questionnaire. Then, statistical sample (including 24 students from 7 to 11 years old with ADHD) was randomly and equally assigned to two groups: experimental group and control group. Each group was 12 people (n=12).

The research design was pretest - posttest with control group. An intervention program of sensory integration was carried out in experimental group.

The grading scale of Swanson, Nolan and Pelham (2001), Continuous Performance Test (Rozvold & et al, 1956) and Toulouse-Pieron Scale (1986) were used to data collection.

A) Grading scale of Swanson, Nolan and Pelham (4th Ed, 2001): This scale is for identifying and assessing the attention-deficit/ hyperactivity disorder, which in this study it was completed by the teacher. The scale was initially made by Swanson, Nolan and Pelham based on diagnostic criteria of American Psychiatric Association (1980) in 1980. Then it was also revised simultaneously with editing fourth edition of diagnostic and statistical manual of mental disorders (American Psychiatric Association, 2000). The scale has 18 items; its first 9

questions are related to attention-deficit disorder and its second 9 questions are associated to diagnosis of hyperactivity disorder. How to calculate the score of subject after the test run is as follows: each question is scored from 0 to 3.

This test has appropriate reliability and validity. Cronbach's alpha for the total score of test was 0.97 and for subtypes was 0.90 and 0.76, respectively (Bussing, R, Fernandez & Harwood, 2008).

B) Continuous Performance Test (CPT): In order to measure students' attention and impulsivity the Continuous Performance Test was used. This test has been developed by Rozvold & et al in 1956. It has been used in attention-deficit/hyperactivity disorder-related researches. During the test, the individual must identify a proper target among goals that are presented on computer screen with an appropriate interval. That's why it needs to maintain attention during an ongoing task and inhibition of impulsive responses. In this case, remove error is interpreted as difficulty in sustaining attention and shows a disregard to stimuli.

Reliability coefficient (test-retest) of different parts of test is 0.59 to 0.93. Test validity has been reported through proper criterion-related validity (Risiv & et al, 2002, quoted by Esmaili, 2005).

C) Toulouse-Pieron Scale (1986): This scale is also used to measure attention degree. This scale was originally developed by French psychologist Henri Pieron and it was later revised. This test is of tests for continuous performance and it is a cross out duty that needs to maintain the attention during the test. This scale is widely used to measure attention. Pages include lines consisting of forms that along each line in the whole page, the target forms are distributed. The person should find them and cross out them during a specified time. This test has various forms; numbers of correct, wrong and forgotten choices are determinants of individual's score in time unit. Reliability of this test in three studies by retest is obtained (Mahshidi, 2001; Sadati & et al, 2009; Rezaeian & et al, 2007 quoted by Abdollahian, 2004) 0.91, 0.94, and 0.96, respectively. The run time of each stage is 3 minutes; the first step is a practice step to familiarity. Then, three test steps are taken that their mean is considered as subject's performance index.

TABLE 1
 SENSORY INTEGRATION INTERVENTION PROGRAM

Session	Type of activity
1	Exercises based on visual perceptions-visual tracking-eye pursuit-image and field perceptions-visual decoding
2	Exercises based on auditory perceptions - aural sequence memory - auditory decoding
3	exercises based on motor - touching perceptions
4	exercises based on the balance
5	exercises based on practice fine motor actions
6	exercises based on gross motor actions
7	Exercises based on spatial awareness
8	exercises based on precision

9	Games aimed at stimulating the vestibular system
10	Combined exercises

Intervention method

Swanson, Nolan and Pelham (2001) Scale which was selected by the aim of identifying hyperactive students was completed by teacher of every student (sample group). Continuous performance and Toulouse-Pieron tests were implemented as pretest before the intervention program about students of experimental group. By this, the effectiveness of intervention program is assessed.

Classes of sensory integration intervention program were held within 10 sessions of 30-45 minute for one and a half months; they were two sessions in a week in Farhang Poya, Tous, and Mohabat schools. The sessions were implemented by the researcher in game room from 10-11 or 11-12 o'clock. At early of every session, tools and equipment needed were placed on the table. During the program, the participants were guided by his imitation. First, a reward, and then verbal confirm was used as

encouragement. In this period, the control group only took the regular school activities; at the end of training period, post-test including CPT and Toulouse-Pieron test was performed for both groups.

In order to evaluate the normality of dependent variables distribution the Kolmogorov- Smirnov test (test K-S) was used. Moreover, to investigating the consistency of two groups before the intervention the independent t-test and Fisher exact test were employed. To obtain the changes for each group after intervention the dependent t-test was applied. Also, multivariate analysis of covariance was used to investigate the effect of independent variable on dependent variable.

3 RESEARCH FINDINGS

TABLE 2
 MEAN AND STANDARD DEVIATION OF SUBJECTS' AGE IN TWO EXPERIMENTAL AND CONTROL GROUPS

Experimental group		Control group		investigating consistency of two groups		
age (month)	M	SD	M	SD	t	p
	118.58	21.76	125.50	17.75	0.85	0.40

TABLE 3
 TEST RESULTS OF UNIVARIATE ANALYSIS OF COVARIANCE (ANCOVA) TO INVESTIGATE THE EFFECT OF INDEPENDENT AND DIFFRACTION VARIABLES ON DEPENDENT VARIABLES

source	dependent variable	SS	df	MS	f	p	(Eta)
diffraction	omission error	46.02	2	23.10	1.15	0.33	0.104
	Committal error	14.99	2	7.50	0.33	0.71	0.033
	Toulouse-Pieron	902.02	2	451.01	6.73	0.006*	0.40
Group	omission error	8.42	1	8.42	0.42	0.052	0.021
	Committal error	34.60	1	34.60	1.55	0.22	0.072
	Toulouse-Pieron	21.87	1	21.87	0.32	0.57	0.016
error	omission error	399.70	20	19.98			
	Committal error	443.91	20	22.19			
	Toulouse-Pieron	1340.32	20	67.01			

As can be seen in table 3, the effect of pre-test (diffraction variable) is statistically significant on post-test score of Toulouse-Pieron. It was not significant about other variables, in other words pretest score affects the posttest of Toulouse-Pieron performance score. Also, some of the variance in post-test was influenced by pre-test which could be occurred due to lack of participants matching based on pretest scores.

4 CONCLUSION AND DISCUSSION

The main question was: whether sensory integration activities cause to improve the attention performance of students with

attention deficit and hyperactivity disorder or not? Sub-question was that: do these activities reduce the impulsivity in children with ADHD?

To answer this question that whether sensory integration activities cause to improve the attention performance of students with ADHD or not, post-test scores of two groups were compared using multivariate analysis of covariance. Meanwhile, the effect of pre-test scores was controlled. Omission errors means of CPT (attention index), and performance score mean of Toulouse-Pieron test (another index for consideration) for groups were compared using multivariate analysis of covariance. The results of this analysis indicated that after the inter-

vention, attention did not differ between two experimental and control groups. It means that despite this that attention increased in subjects that participated in sessions, this increase was not enough to be significant difference between two groups. It was expected that after 10 sessions of sensory integration activities, the attention of participants improved. However, the improvement was not satisfactory. About why the intervention did not stop the expected result the following reasons can be expressed:

1. One of the issues in developmental psychology is discussion about critical periods of growth. During these periods, the growth is rapid as well as the structures are flexible. Neuropsychological researches argue that a rapid growth occurs in attention between the ages of three to five years. It has correlation with development of brain structures and functions. Furthermore, the main assumption in attention training is that doing assignments that require consideration caused the structures and networks to be improved. So, as Pasner says these exercises should be provided early in the growing period. However, this study was conducted on students who were in age range of 7 to 11 years. Thus, it can be concluded that for more effectiveness, sensory integration activities program should be carried for children out during the pre-school time.

2. According to this that one of the principles of attention training is that ample opportunity must be provided to repeat assignments (Solberg & Metir, 2001, quoted by Alizadeh, 2007). This intervention was conducted in 10 sessions; because the parents did not cooperate with investigator, the subjects did not practice it at home. Therefore, one of the reasons for low efficiency of this program can be attributed to insufficient number of sessions and lack of repeating tasks at home.

To determine the effectiveness of the intervention on children's impulsivity, committal error scores in post-test were compared between two groups using analysis of covariance. Subjects of experimental group had a greater reduction in number of committal errors. It means that their impulsivity had more decrease than subjects in control group. But the results of multivariate analysis of covariance showed that the difference between two groups in post-test was not significant when the effect of pre-test controlled on post-test. Although the sensory integration intervention decreased the impulsivity of experimental group, these changes were not enough to make a significant difference with control group. Positive effects on committal error variable can be induced by continuous involvement of subject in doing task and the effect of verbal feedbacks during the task. For general conclusion can be stated that this study could not provided evidence for the effectiveness of sensory integration activities on attention performance of students with ADHD. Although people's attention improved compared to before intervention, by controlling the effect of pre-test it was found that this improvement was not significant.

Among the limitations of this study was time limit for doing more interventions, because to improve the attention in chil-

dren, especially children with attention-deficit hyperactivity disorder further intervention is required. Additionally, clear theoretical framework is not still presented for how sensory integration activities impact on attention process. In this study, psychological valid tools were used for assessing attention. However, to determine the behavioral changes of subjects it was required to use behavioral assessment techniques such as careful observation. According to test power, it was found that the sample size used in this study should be high. Also, the families did not cooperate with researcher to do exercises at home.

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