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# The Impact of a Selected Exercises Course on Visual Perception of Children with High Performance Autism Spectrum Disorders

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**Abstract:** *This study aims to investigate the impact of a selected exercise course on visual perception of children with high performance Autism spectrum disorders. The present study is applied in terms of purpose and was done as a quasi-experimental study. The statistical population of this study were the clientele with Autism spectrum disorders in Autism society of Shiraz with age domain between 9 to 12 years old who did not have any certain physical and visual problem and did not have any severe chemotherapy and was not able to attend exercise sections, then the subjects were randomly divided into two groups (12 people for selected exercise and 12 people for control group) and after that Raven TVPS (Test of Visual Perceptual Skills) and GARS (Gilliam Autism Rating Scale) tests were done a week before main test and (one week) after the last exercise section, the mentioned tests were given again (posttest). For analyzing data, ANOVA (One-way Analysis of Variance) and Tukey tests were used applying SPSS software (version 16) at 0.05 confidence level. The results showed that a selected exercise course impacts on children visual perception (visual detection, visual acuity, visual-spatial relation, visual formation stability, sequential visual acuity, visual base formation, children visual perfection), so selected trainings can influence on visual perception of children with high performance Autism spectrum disorders.*

**Keywords:** *Selected Trainings, Visual Perception, Autism, Performance*

## Introduction:

### Problem statement

World Health Organization (WHO) and American Psychological Association (APA), have categorized Autism disorder in a subgroup of generalized evolutionary disorders, which is the result of Central Nervous System (CNS). According to this definition, children with Autism disorder have deficiency in social interactions, verbal and nonverbal communication, interests, activities and imagination. In Autism disorder, social interaction is highly damaged. In applying various nonverbal behaviors such as face-to-face look, facial expression, body demonstrative movements, social interaction adjustment and communicate, there may be impressive disorder (APA 200). Almost usual characteristics of Autism is isolation and severe tendency to solitude, obsession and anxiety. These children are generally seemed relax and do not show any physical and spiritual reaction to other people kindness and speech disorder is one definite symptom of this disease. The existence of stereotypes as motorized or non-motorized behaviors and masochism are problems which can be seen in these group (Pen,

2009: a significant population of each society suffer from this disease, according to Centers for Disease Control and Prevention (CDC) in 2014, Autism disorder prevalence is 1 in 42 boys and 1 in 189 girls. According to this report, 1 in 68 children in some states of United States, suffers from Autism Spectrum Disorder (ASD).

These children disturb from sensory information processing, thus react to sensory stimuli abnormally (Rajabi, 2014), therefore, the treatment of sensory interaction in daily activities, helps Autism spectrum (smith,2014); Disturbance in processing sensory information leads to weak perception in right self-diagnosis which impacts on social relationships and communication skills. Perceptual development and motor development do not occur separately, people move to experience perception and to experience movement, perceive (Gallahue, 2011) and perception and movement are interdependent and acquiring motor skills requires perception skills and vice versa, children who have perception disability have problem with interpretation and explanation of environment implication (Smith, 2001). Since visual perception plays an important role in daily activity and there is little doubt about growth level that perception-visual ability impacts on performance level of motor skills, knowing and understanding the growing perception skills of child and the impact of perception on learning and modifying motor skill is very important (Galahue, 2006). The influence of visual perception defects on daily life is very high which is abnormal in people with Autism (Maurice et al., 2015). They respond overly visual feedback (Molemole, 2014) and also there is an optical inconstancy in people with Autism (Milen, 2007). In terms of mirror neurons nervous, a large number of social-cognitive functions such as imitation perception and excitement perception in premotor cortex of f5 area relate to this system, that mirror neurons are known as visual motor neurons. Researchers have mentioned that system failure of mirror neurons can lead to social harm especially Autism spectrum (Ahadian, 2015); and this perception disorder can cause movement disorder in Autism spectrum and leads to movements problems which result in social disaffiliation (Pen, 2011) and on the other hand acquiring a suitable motor skill helps to the ASD ability in relation to language development (Translader et al., 2008), playing and interacting with other people (Keller Field, 2011) mental imagery (Willy Serlo, 2008) and perception (Blacksi & Wilson, 2010). So that, they require significant sources of therapeutic interventions for multiple problems preparation. Although, as yet no unique method has been introduced to treat or recovery diagnosis symptoms of this disorder, anyway various therapeutic interventions have been done by analytical psychology, psychiatrist, nutritionist, behavior therapist (Gibbs, 2010). Over the past thirty years, new intervention method based on motor activities has been studied for improving diagnosis symptoms and problems associated to Autism spectrum disorder (Staplis et al., 2011). Researches have shown that participating in motor and physical activities, has resulted in developmental, social and educational tremendous progresses in children with Autism spectrum disorder (Pitet et al., 2007). Researchers have reported the effects of interventions based on various motor-physical activities on diagnosis symptoms and also problems related to children with Autism spectrum disorder recovery and as a result, improve in their family standard of living (Staplis et al., 2011). In all studies, some evidences have been observed in these people based on repetitive behaviors reduction (Kuner, 2000), social interactions enhancement (Garci et al., 2011), explanatory communication enhancement (Gabriel et al., 2008), and also positive changes creation in academic skills (Oriol et al., 2011), swimming skills (Rogers, 2010), physical fitness (Fargela, 2008), in-water skills (Pen, 2011), sensory skills (Wang, 2011), self-harm behaviors (Eliot, 1994), perception imitation skills (Himeyuri et al, 2010) and stress reduction and life quality enhancement (Garsi et al., 2010), using motor trainings such as walking (Pitet et al., 2007), running (Ticolson et al., 2011), swimming (Yilmaz, 2007), hydrotherapy (Boomin et al., 2003) and social and recreational activities (Pen, 2010).

Although the number of conducted studies for investigating the effects of interventions based on motor activities in decreasing stereotypes of people with Autism spectrum disorder, is somewhat admirable, but in some important identifying areas such as communication and social interactions and motor and visual perception problems, there have been done less researches.

A careful investigation of conducted researches, reveals several deep research gap in this area:

1-the length of empirical courses are almost very low in all researches.

2-there have been little research in the field of visual perception of people with Autism spectrum.

3-in these researches, designed motor activities that help to enhance the eyesight sense processing, have not been used.

Currently, this quasi experimental project with sufficient number of participants, along with control group has been set up like, the effect of these exercises on Autism visual perception parameters improvement is examined through it.

#### **The process of research conducting**

Selected exercises were done in experimental group in a 3-month period and 3 sessions in a week and its duration was 40 minutes that was used by 4 instructors who have spent their job training with Autism children and for investigating the visual perception test and consultation in a selected exercise a psychologist was employed.

Post-test: 7 days (according to prior research) after the last exercise session, GARS-2 and TVPS tests were taken. In this research, descriptive and inferential statistics were used to analysis data.

Descriptive statistics were used for table creating and statistics indicators such as Mean(Mean), Standard Deviation(SD) and Standard Error of the Mean(SEM) calculating. Before the test and statistical analysis, the normality of dependent variables distribution was investigated by Kolmogorov–Smirnov test (test K–S). After that One-way Analysis of Variance and Tukey tests were used in experimental and control groups for hypothesis testing. The data will be analyzed using SPSS (version 16) software and confidence level is considered 0.05.

#### **Method**

Boys with Autism spectrum whose disease diagnosis time was at least 2 years ago, were selected, that their age range was between 9 to 12. Also they have not attended any sportive course. After sample selection and filling letter of satisfaction, pre-test was taken. Since people are changing mentally and spiritually, in this quasi-experimental and clinical study, to access stability and versatility of researcher intended features, it is better to use multi-evaluation stage (with parents, coaches and respective physicians) to reach the stability of intended feature for doing the task.

#### **Research conducting process:**

The exercises were done in a 3-month period as three sessions in a week in experimental group and the duration of selected programs performing was 40 minutes which consisted of 5 minutes for body physical warming up and 5 minutes for body physical cooling down at the beginning and the end of the performance and the duration of exercises was about 30 minutes. Also, four well-versed coaches with enough experience and practice about children with Autism supervised and applied these exercises in rehabilitation clinic. So that each of coaches have exercised selectively with three boys with 9-12 years old age average and 140.095 height average and 32.99 weight average. It should be noted that in order to prevent the homogeneity of exercises and children conditioning, the sequence and order of exercises has changed in each session. As well as, according to parents and coaches experiences and special attention of these children to red, and also for motivational accompaniment with them, this color has been used particularly in exercises with emphasize.

Considering the fact that one of the outstanding features of these children is weakness in social interactions and learning with slow and time consuming proceeding, various persuasive excitedly verbal methods such as good, bravo, excellent, well done or clapping and .... as far as possible were used. Also, to prevent pressure on these children as soon as it was observed that they are tired or reduction in their feedback responses and progress process, the child was allowed to refresh and the rate of coaches demand and request decreased. Also, in hitting the ball or throwing the ball, at first on order to determine an appropriate distance with children ability to throw the ball, they were asked to throw the ball with maximum potency, so that the average of these distances was applied too.

Since the achievement of positive therapeutic results in motor disorders of these children is mainly focused on practicing and repeating and emotional reactions and sessions divisions, the selected trainings are designed as follows.

Meanwhile, these exercises were called Yazdani's perceptual-movement exercises

**Selected program No.1:**

The first exercise consists of running in a path which is helical- spiral and red and is designed with margins adorned with LED strip, so that connecting and disconnecting electricity in these lamps was along with various slow, moderate and fast sequences and different time distances. At the beginning of sessions, almost in three groups a short pause, including children staring at light current disconnecting and connecting was observed, which was resolved over time. At the end of course, children running was versatile and with progressive speed, which showed a good consistency with the purpose of change in acuity skill.

**Selected program No.2:**

This exercise which is designed based on ball hitting to requested goals with emphasizing on keeping the head constant, was done as follows: children were placed 1 meter far from the wall on which white frames with colored numbers 1 to 5 and with disordered and various distances were prepared, and coaches asked children to hit the ball to intended points. Given the fact that for easy access to ball, a basket containing colored balls was placed near the child, coach could control his/her request speed incrementally and decreasingly which was remarkable in accordance with pressure reduction on child. And also, because of fatigue deficiency in child, his/her ability to pay attention to coach admonition about keeping the head constant during the exercise is not reduced. During this program, eye and hand coordination and balance in motion showed a quite increase process over time and at the end of sessions.

**Selected program No.3:**

This exercise was done with the same conditions of exercise No.2. child was asked to stay 1 meter far from the wall and hit the ball with foot straightforward, left and right alternately. During the exercise, the coach has used verbal encouragements along with excitement, because he/she did not feel obvious coordination in child, so that it helps greatly to motivational continuity of exercises done by child. At the end of sessions, improvement in accommodation skill and coordination of eye and foot movement were observed clearly in children.

**Selected program No.4:**

In this exercise the child was asked to stay in a center of a circle and the coach threw white and colored baseballs from 2 meters distance and the child had to hit the balls with baseball bat. For more interaction between two factors, balance and adaptation, the coach changed his/her place systematically. Although, the level of failure and unsuccessful heart rate was considerable in each session, at the end of sessions the process of accommodation and unsuccessful heart rate control was progressive.

**Selected program No.5:**

During this exercise which is the most challenging selected program, three large, medium and small colored rings were used which were placed respectively in 1.5, 2 and 2.5 meters far from the child. These rings were placed suspended and attached to the ceiling with invisible string in a half a meter from ground and were moved to left and right in order to keep children focus. For ease of doing exercises by children and well passing of the ball, the large ring was placed at the beginning of the path. Then the coach asked the child to throw the ball inside the moving intended rings. In this exercise, the number of unsuccessful throws was considerable, but nevertheless children welcomed that exercise and were willing to continue the exercise even after time completion. At the end of sessions, enhancement in adaptation and convergence skills along this exercise was observed and improvement in similar activities was confirmed by parents in other environments.

**Selected program No.6:**

During this exercise, the child was placed in a circle center and while his/her hands were open, had to keep his/her head steady when he/ she was taking the ball. For more complete cooperation and interaction with the coach, air, light and colored balls were used. So that the child could control his/her attention and accuracy to

keep his/her head steady despite the continuously oriented movements of the coach. Forgetfulness in keeping the head steady was observed at the beginning of the sessions but at the end of the sessions, with coach notification enhancement and increase in accuracy and attention in keeping the head steady, environmental perception improvement and balance development was observed considerably by this exercise.

#### **Selected program No.7:**

In this exercise which was designed based on the ability to control and balance during the jump, using trampolining and prepared rings beside that with different heights and places (back, front, bottom, top) and various colors on which numbers were carved, the coach asked the child to jump on trampolining plate at the same time throw the ball in to intended rings. Given that the success in this exercise is somewhat difficult for children with Autism, but in this autistic group different functions and reactions were observed. For example, some children lost their balance when they were throwing the ball and was concentrating. And some children forgot to throw the ball in to the ring and they seemed to focus more on jumping and not falling than throwing the ball, so that based on this issue at the beginning of sexercise, the coach allowed the child to continue playing and jumping for a while without asking to throw the ball or have some simple jumping with ball and not throwing. Observing positive results continued slowly and with a lagging process but concentration progress and balance along with depth perception related to visual perception was sensible. So in the last sessions the child tried to approach him/herself to ring along with jump power enhancement.

#### **Selected program No.8:**

In this program some people with colored and unequal dresses were used. While they were all moving irregularly as a person with a ball in hand and in a circle, the child was asked to pass the ball to the person who did not have a ball and at the same time look at the circle center. The process of diagnosis speed and environmental consciousness development in children were perceptible in the third month. Considering this fact that the selected people were chosen from parents, so that children could manage their attention to their parents and themselves without ball.

#### **Selected program No.9:**

In this exercise the child is placed at a 4-meter distance from a wall on which there is a ring that a 8-meter rope passes through it, at two points of the rope there are two same color globe, so that the child can take and adjust the rope in a state that they can be parallel. This program was somewhat time consuming for child but it seems that over time and with coach accompaniment and repetition and notification of two globes symmetry, the child was willing to do the exercises correctly and this exercise is effective in depth perception of these children.

### **Findings**

The results of this test is presented in (1) table. As can be seen, since the confidence level is 0.50, so there is a significance difference. For finding different groups, Tukey multiple comparison was applied.

**Table 1:** One-way Analysis of Variance of visual perception

Description	Sum of squares	df	Mean squares	F	Confidence
Between groups	13.164	1	13.164	6.603	0.017
In groups	43.859	22	1.994		
Sum	57.023	23			

**Table 2:** Multiple comparison test

Test	Group	Mean difference	Standard error	Confidence level
Pretest-posttest	Control	0.073	0.221	0.672
Posttest-posttest	Control-experimental	-1.21	0.379	0.038
Pretest-posttest	experimental	-1.48	0.461	0.018

According to above table results, since the confidence level of test in experimental group is 0.018 less than 0.05, so the visual perception mean in posttest is significantly different with pretest, namely the mean of posttest score is more than pretest and also the confidence level 0.038 in the second group means that the selected exercise has affected on visual perception.

### **Discussion about the results of visual perception**

The results related to raw scores mean of visual perception and also visual perception parameters in experimental group participants, who were under the relatively long term training of selected exercises, showed a significant increase rather than the control group and also no results based on the effect of motor activity on visual perception of children with Autism was found in prior studies discussion, so that we consider the closer studies to this research. Other study results indicate that less scores in visual perception is related to poor participation of children with Autism. There are numerous studies based on the existence of visual processing problems, such as difficulty in general image processing and difficulty in faces processing, in children with Autism. (Vlaminckx, 2010). Some features of Autism disorder, such as not making eye contact, has also been considered as a compensatory approach for visual processing problems (Tomcheck, 2007). The weakness in central coherence explains that how does visual processing of people with Autism work? Central coherence is a process in which various information are integrated and are used in a specific field. Failure in this process can lead to weird attention to information details and prefer details rather than generalities. People with Autism have disorder in combination and integration of information details in a meaningful and coherent format and instead focus on details of a stimulus through visual processing and this detail-oriented bias leads to disability of these people in total processing and information integrity. Children with Autism are disabled to extract abstract and holistic concepts from visual stimulus of their environment because of weakness in central integration and related processing, which can effect on the children participation in activities (Bairami, 2014). Jasmin (2009) stated in his study that difficulty in visual processing can also effect on eye and hand coordination process and limit the participation of children with Autism in activities which require this skill such as wearing dress. Also Koosbi (2010) stated that children with sensory processing problems, participate less in activities which nature require visual processing skills, such as puzzle and playing backgammon and cards. In Nadoon study (2011), it was observed that visual processing is related to the problems of children with Autism in participation in eating food. The results of Zienkiewicz (2009) showed that there is no considerable relation between visual processing and participation of children with Autism. The reason of the differences of Zienkiewicz study can be used as applied tool for participation measurement.

In physiology book of Guyton and Hall, the adjacent crevice central area in frontal lobe of cerebral cortex is considered as motor area. The neurons of this area, using cortex along with lower parts such as basal ganglia, mesencephalon(midbrain), pons, reticular substance and medulla oblongata, control skeletal muscles, so totally, in terms of scope, a limited part of hemisphere is engaged in hand and foot movements control. This is while that visual path starts from optic nerve in Retina and passes through optic chiasma and by passing from temple region, forms optical tract and after that synapses with posterior external spinal geniculate nucleus of Thalamus (which also interferes in sleep and awakening cycle and many other vital functions) and after that Geniculocalcarine fibers reaches to initial optic cortex in occipital lobe through visual radiation and frontal eye field is also drawn from facial area in precentral gyrus to middle gyrus (parts of 6, 8, 9 Brodmann area). It seems that nerve fiber of this area is related to Brachium of superior via reticular formation with extraocular muscles of globe. Optical area of frontal lobe control autonomic eye movements in careful check and act autonomously from visual stimulation and involuntary pursuit of moving objects by eyes which requires the connection of occipital cortex of visual area with optical region of frontal lobe via collective fiber (a factor which seems to be involved in eye superiority), in general goes through longer visual path of brain hemisphere and also mirror neurons are particular categories of visual-motor neurons. These neurons were first identified in

premotor cortex (F5 area) of Macaca. A large number of social cognitive functions such as action, theory of mind, imitation, perception of emotions and feeling of other people are related to human mirror system. This function has significant defect in Autism spectrum disorders. A set of Autism symptoms in a faster neurodevelopmental defects context (damage in relations, language, excitement and ability to understand other people) are relevant to mirror mechanism functions. Researchers have proposed that rough operation of mirror neurons system causes social harms, especially Autism spectrum disorder. Collection of these defects in these disorders may be based on damage in mirror mechanism. A FMRI study has provided strong evidence to support the defect in mirror mechanism in children with Autism. The results of the brain of children with high function Autism showed that activation in frontal lobe gyrus was significantly lower in children with Autism than normal children (Kazemi, 2014 and Brich et al.) and many brain, sensory and motor, cerebral and sub cerebral systems are activated via visual inputs. All of these systems are competing with each other in terms of stimulation amount. Despite the competition between these systems, there is also an integration among all of them (Duncan, 1996). So that, according to brain modality model, visual stimulation preparation play stimulus role not only in visual system but also in other systems. This confirms the effect of visual stimulations in this study. In neuro psychological discussions, frontal areas act in a close relation with motor cortex in order to plan the designs and motor acts complex sequence. Most of the discharging signals pass from prefrontal area to motor system through feedback orbit section of Thalamus basal ganglia in order to plan the motion. This section provides many parallel and sequential components of motor stimulation. This is probably due to some capabilities of prefrontal cortex which enables motor planning. The existence of optical region and mirror neurons and also motor section in frontal part help to explain this hypothesis that visual perception and behavioral and motor disorders are related and although there has been done no experiment in this field, it seems that selected exercise is not affectless in creating synapse relation in these three parts in frontal part. A review study done by Guven in 2013, showed that problems in sensory processing (especially in visual, touch and depth sense) along with effects on movements planning and adaption, play a significant role in creating movements problems in people with Autism. Also Bhatt et al., stated that sensory processing problems of children with Autism is directly related to motor coordination and Postural control of these people. Processing and integrating senses, provide a base for body schema development and internal model which give the person this opportunity to predict sensory motor orders results and learn from errors in order to improve the performance and states the important role of sensory processing in motor performance. The results of Reynolds study is somewhat in line with present study results (Boomin et al., 2003) and on the other hand, for explaining this hypothesis can be stated that Seton and Hall (Uder et al., 2006) Schlumberger et al., (McDuffie et al., 2005) believe that visual perception skills is such hierarchical skill levels that the person reach to a higher skill. For reaching to a higher level of skill, the person should have lower level skills.

Higher levels skills effect on lower level of visual perception, these skills are closely integrated, selected exercise improve low level skills such as adaptation ease (exercise No.4), eye convergence and eye and hand and foot coordination (exercise No.2,3), perspicuity (exercise No.1), environmental perception confirmation pursuit (exercise No.8) and depth perception (exercise No.9), in addition they improve high level perception skills. For example, Jasmin (2009) stated that children with Autism who had weaker status in body and postural situation processing, gained lower scores in WeeFIM test and had less participation in daily life activities. Disorder in the field of visual- spatial skills which is one parameter of visual perception creates growth disorder in body schema which is base of all movements and helps to understand that where and how body moves. A person who has problem in this field, has also difficulty in the field of motor balance and harmony. In selected exercise No.1 and No.7 these exercises are discussed.

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