

THE COMPARISON OF MOTOR-COORDINATED SKILL IN STUDENTS WITH DYSGRAPHIA DISORDER AND NORMAL ONES

Sakineh Soltani kouhbanani¹, Raziieh Khosrorad², Abolfazl Rahmani Sani³

1. Department of General Psychology, Science and Research Branch, Islamic Azad university, Ilam, Iran
2. Research Center on Social Determinants of Health, Sabzevar University Of Medical Science, Sabzevar, Iran
3. Department of Environmental Health Engineering, School of Public Health, Sabzevar University of Medical Sciences, Sabzevar, Iran

Abstract: In attention to the growth of motor skills which is a base for later learning, the students with dysgraphia disorder have some kinds of problems in this issue so this disorder somehow should be treated which their motor difficulty vanished before education age. **Material and methods:** 20 male students age from 9 to 11 with dysgraphia disorder base on criteria of DSM-IV, Wechsler intelligence test and Kelchy writing test (2007) have been selected as experimental group and 20 male students with same age have been selected as control group too. The both groups have been investigated by motored growth test (Lincon oseretsky test) and then accumulated data has been analyzed by the statistical software of SPSS10 and T-test. **Findings:** the students with dysgraphia disorder had weaker performance in the motor growth test of Lincon oseretsky, they also have problems in the arrangement of movement, motor inhibition, motor balance, harmony, motor flexibility, quick displacement and the rate motor activity. There was significant difference between the gross motor skill of students with dysgraphia disorder and normal one ($p=0.003$). The handy fine motor skill of the students with dysgraphia disorder significantly was weaker than normal students ($p<0.001$). The harmony and balance of the student's hand with dysgraphia significantly is weaker than normal students ($p<0.001$). **Results:** According the acquired results, this idea can be created in the mind of experts and therapists that motor-coordinated evaluation probably can be useful for prevention and treatments of children with dysgraphia disorder.

Keywords: movement skill growth, students, ADHD, rehabilitation

INTRODUCTION

Writing disorder (dysgraphia) is one of the most common learning disorders which considerably interfere in the daily life and educational progress of children. Reading and writing are to essential skill in the today life and those who haven't these abilities are in the bad situation. Much needed information is presented in the writing form (newspapers, magazines, books, etc. paying attention to this issue which writing is one of the basic skill for passing educational courses, it is also important for daily basic skill such as Writing letters, filling out forms. Among the basic academic skills, writing skills has been called the most visible. The difference between the writing and the other communication skills is that writing has documented form. According to existed census 85 to 90 percent of children with learning disability have reading problem and even 25 percent of them school failure is related to the reading disability. Reading disorder of the boys is 2 to 4 times more than the girls (Mack Labin and Wallace, translated by Monshi Tosi, 1990).

Children during infancy and early childhood pass the sensory-motor stage. In this stage children with their senses and motion can acquire experience from their environment.

The grow and motor control of human body is from head to toe, from the inside to the outside and from the large muscles to small muscles. Human's babies first are able to control head then respectively spinal cord, arms, legs and bottom parts of the body such as the wrist and fingers. The growth of Child's motor skills, make them able to control the environment. Motor behavior of infants first is reflective then voluntary and cognitive control come with physical development especially development of motor and cognitive skills. Actually the most basic type of child's behavior is muscular and motional. The children perceive the world with these motor behavioral actions and this motor experiences is the base for his/her learning. In the childhood period the continuity and merging of motor and intellectual activities are very high. During the first years of childhood, the motor skills of the hands and feet grow quickly, but fine motor skills such as the ability to coordinate eye, hand and finger movements is not yet well developed. That is the reason why young children prefer to play games which involve gross motor skill not fine motor skill. In the primary school gross motor skill

pattern will be fixed for children and the child can participate in the sports such as running, jumping and throwing. Many of these skills obtained by combination of the hands, eyes and feet movements. Also writing, sewing and making the crafts that require fine motor skills will be possible in these years.

The complexity of talents and motor functions associated with age-related increases in two different streams which appear together, occurring the complexity of the motions somehow revealed the recognition ability of children and a child gradually learn to omit extra and unnecessary movements and instead learn purposeful movements. Also motor ability and cognitive abilities have fixed relationship. (2) The definition of motor- perceptual activities and the determination of its impact on the learning process are essential. Received messages by the senses (sight, taste, tactility, smell), after receiving and decoding the data will be interpreted with past experiences and necessary decisions for action will be taken. These decisions with the peripheral nerves will be transfer to the limbs and response mechanism will occur, this process is called output which at the end shows it's self as motor or verbal response. Development and coordinated evolution prepare the child for gross motor activity. (3)

Keapart believe that mental development of child will start with movements control then stages such as regular discovery, perception of problems and combination and completion of the sensory perception and at the end formation of concepts in a more complete and complex than the previous stages will happen. Normal children are simply steps in the right order, but for the children with disorder these abilities will postpone to the later time. Some evidence has shown that there is a relationship between behavioral inhibition and motor control which has been discussed. Motor problems of the children such as fine motor coordination, balance, the spiral form of paper and pen and tracking show that there is fundamental problem in these children. For example, the writing and drawing are motor behavior that requires flexibility, complexity and applying the fine movements. Children with dysgraphia have significant weaknesses in this area, so we can say that these children in the planning and accurate and quick implementation of frequent and complex movements have problem. Keapart also believes that intelligence and education is effective in motor learning as he in his book "slow learner in the classroom" stated that "if we assume that all the behaviors are basically motor behaviors, the prerequisite of any movement is muscular and motor responses». Keapart proposed a tool for measuring motor-perceptual responses which includes the testing and observation on five major areas:

1-equilibrium: is walking on the wooden rail to forward, backward, sideways, jumping with one foot and two-foot-2-body imagination and recognizing the difference: a) Identify the different parts of the body, b) miming c) chasing the goal d) two practice in relation to fitness f) Angel on snow 3 motor-perceptual link 4- eye controlling 5- shape perception. The application of Keapart instruction has been approved for children with motor and coordination problems.¹⁹ Writing is a very complex developmental and neural process which involves multiple mechanism of the brain. Writing requires stimulation and integration of attention series, multiple sources of information, memory, and motor skill, verbal and higher cognition of skills.

20. Motor coordination, motor memory, phrasal kinetic melody that Luria has used requires balance, flexibility and proper use of motion, stimulation some groups of muscles while the other have been inhibited.. So for automatic writing, sight, appropriate movements, automatic motor memory and corrective feedback mechanisms must be involved (Kay, 2006). Kinetic feedbacks include awareness of finger movements and their locations in the space, internal adjusting of the rhythm and the style of using pencil. Motor memory feedback mechanisms include visual-motor coordination for producing the symbols, chain making, speed and precision.

21. Corrective feedback mechanisms include visual memory for signs, memory of words, visual attention to detail and pronunciation. All these skills are needed for developmental readiness and can be improved with practice (Kay, 2006). Visual feedback mechanisms involve eye-hand coordination and visual motor coordination. The basic prerequisite mechanisms for writing language (Kay, 2006): (1) include 1- a healthy central nervous system 2-healthy cognitive ability 3-healthy language skills (both incoming and verbal) 4- Motivation 5-developmental skill 6- Practice 7- emotional stability.

Lim (1979) considered six basic skills for writing as follows: 1.The fine skill abilities for controlling inner muscles 2. The continues coordination-motor-ability, picking up the hand under guidance and eye monitoring3- The ability to shape fine movements, lines, rotate, etc. 4. The ability to hold writing tool 5- perceptual distinction, recognition and awareness of shapes, lines, and the letters which is needed to build shapes 6 the orientation of written language including visual analysis of letters and words along with the ability to distinguish between right and left.

23. In the other research different list for required skill has been presented. 1. The child must reach to the developmental level of abstraction play. 2. The child must be able to distinguish between shapes and sizes. 3. Basic understanding of abstract concepts 4. Having a good balance to sit independently 5-keeping shoulder and wrist to control pencil. 6-Controlling a hand for writing and use the other one for holding the paper7-adequate accordance of body and eye. (Klein, 1990; cited by Newman, 1999), usually the fingers quickness is abnormal in the dysgraphia which caused by motor

deficits. Studies conducted by the Meckil and Kermack(1992) showed that 30 to 60 percent of class activities requires appropriate motor skills and 58 percent of these tasks are done with pencil and paper.

Lerner (1971) mentioned the problems which caused writing disorder 1- weakness in the motor skills somehow the hands and fingers don't turn properly for writing letters 2-The error in the visual perception of letters and words 3- difficulty in maintaining visual experience 4- anxiety and restlessness.

In order to assess the motor developmental performance, Lincon oseretsky test can be useful for measuring the gross and fine motor skills, educational locating and educational planning (5). Gross motor skills are activity such as jumping on the rope, grab the ball and throw it, they are associated with large muscles of the body. But fine motor coordination directly are related to the growth and development of small muscles of the hand which are used for the tasks such as writing, threading, assembling the nuts and cutting, manually carrying out of all these tasks successfully will lead to forming positive self esteem and academic achievement. Balancing and harmony also is person ability to maintain and restore the position and statue of the body which is the basic element for all motor skills. Having good body balance is the sign which indicated a person internalize the relationship between the body gravity and reliance level. When the body finds balance that body gravity directly is located on the reliance level. Vestibular system or semicircular ducts in the inner ear is balancing set of the body, of course visual perception have important role in the maintaining the body balance too. Children gradually maintain their balance in static conditions and on the low surface of wide ones then on the long and narrow surfaces. (6) Flexibility and complexity include alternate opening and closing the hands, tapping with feet, circle drawing with fingers and wrapping the thread around the bobbin on walking, these activities involve group of the muscles and requires more concentration and practice, as well as a healthy nervous system.

MATERIALS AND METHODS

The participants were 20 boy students with dysgraphia from age 9-11 that have been classified according to DSM-IV and writing test of Kelachay (2007). Base on the Raven's test these children IQ were upper than 89 and they haven't clinical problem except dysgraphia. The control group consisted of 20 boy students in the same age with experimental group that base on their parents and teachers interview they haven't problems and their IQ average were upper than 90. All participants were evaluated with the following tools.

Wechsler Intelligence Test

For measuring IQ of students with dysgraphia Wechsler Intelligence Test (revised scale) was used. Retest coefficients of test was 24 to 94 percent and retest coefficient with test halving method was reported from 42 to 98%. Correlation coefficients of verbal and nonverbal subtests and total scale with Wechsler revised scale for preschoolers were respectively 84, 74 and 85 percent. These values are comparable with values reported in the manual of the Wechsler test (19).

30. Falahchay, s written expressing training

This test is used for diagnosing and measuring the writing level ability of examinee with dysgraphia disorder. Test validity was reported 86 in the Falahchay research. This test for each school grade has two texts which include first half of Farsi book then total volume of Farsi book. Falahchay writing test has been designed according to the grade of elementary students (20).

32. Motor development test of Lincon oseretsky include 36 move which each have s score. Sometimes the score is given to the movements that have been done with one hand, either hands or both legs. Totally has 159 score and the tables for scoring base on the age and sex has been attached to it. The test subsets are gross motor, fine motor subtests, balance (equilibrium) and flexibility (complexity) (5).

From twenty districts of Tehran education system, randomly two were selected then from these two districts four schools were selected. Examinees were diagnosed with dysgraphia after interviewing with their teachers, implementing Wechsler test and Kelechay writing test (2007) and controls group have been selected base on assimilation with experimental group (age and IQ). Then Lincon oseretsky test were individually performed for both groups.

34. Data were analyzed using SPSS-11.0 software. Statistically to determine the significance of variables differences in the both groups T-test parameters were used. Statistically the level of P less than 0.05 was considered significant.

Findings

Table 1. The Table SD for examinees age and IQ

| G | Normal | Group of dysgraphia |
|-----------------------------|---------|---------------------|
| Anhra Nhra age criterion F. | 57119/1 | 53941/1 |
| Anhr SD IQ | 7137/13 | 7231/11 |

In the table 1 the characteristics of both groups were compared, the T- test shows no significant differences between the age and IQ of children with dysgraphia and control group. It showed that two groups for age and IQ have no differences.

Table 2. The comparison of gross motor scores in the group with dysgraphia and normal group

| View Groups | Number | Acquired scores | Standard deviation | Standard error of difference | The significance level |
|---------------------|-------------|-----------------|--------------------|------------------------------|------------------------|
| Normal | 20 students | 1667/14 | 1713/1 | 2725/0 | 05/0 |
| Group of dysgraphia | 20 students | 1626/8 | 9116/1 | 3125/0 | 05/0 |

First between the gross motor behavior of children with dysgraphia and normal ones the comparison was done. These movements include (jumping on the rope, catch the ball, throw the ball, jumping and touching the heel) which totally are four separate moves. In this section we try to evaluate the performance of gross muscles. In the table 2 the comparison of two groups has been done base on the T-test and then the significant differences were observed as $p < 0/05$ and $t(38) = 11/064$. Students with dysgraphia have lower scores and weaker performance in the gross motor movement.

Table 3 The comparison of fine motor scores in the group with dysgraphia and normal group

| View Groups | Number | Acquired scores | Standard deviation | Standard error of difference | The significance level |
|---------------------|-------------|-----------------|--------------------|------------------------------|------------------------|
| Normal | 20 students | 2163/29 | 2538/1 | 4316/0 | 05/0 |
| Group of dysgraphia | 20 students | 1433/18 | 0649/2 | 6241/0 | 05/0 |

86. In the next section of the study the comparison of fine motor movements between two groups have been done. In this study fine motor include (touching the tips of the fingers, finger movements, making the ball, wrapping the thread around bobbin, draw a circle in space, arranging matches, line drawing, circle cutting, putting the coins in the box). Table3. Showed the comparison between the two groups on subtests related to the fine motor, the value of T-test is $T(38) = 2/897$. The group with dysgraphia has lower mean score on this subtest.

Table 4. The comparison of balancing and equilibrium in the group with dysgraphia and normal one

| Sat mesh characteristics groups | Number | Average rating actions | Standard deviation | Standard error of difference | The significance level |
|---------------------------------|-------------|------------------------|--------------------|------------------------------|------------------------|
| Normal Ggrvh | 20 students | 2633/27 | 8255/1 | 5438/0 | 05/0 |
| Group of dysgraphia | 20 students | 6333/15 | 1450/2 | 484/0 | 05/0 |

106. In addition to the gross and fine motor movements' comparison, this study paid attention to the comparison of balancing and equilibrium movements. these movements include (walking backward, standing on top of the toe, standing on one leg, standing on the feet somehow the right leg is located and attached to the front part of the left foot, keeping the wood balance, keeping balancing on the tip of the toe, jumping and rotating, standing on one leg with closed eye, keeping balancing on one toe of feet, balancing a stick of length). Table4. Showed the comparison of the balancing and equilibrium in the two groups of examinees, the T-test value was $t(38) = 6/410$. The group with dysgraphia has very lower mean score on this subtest compare to the normal ones.

Table 5. the Comparison of flexibility and complexity movements in the group with dysgraphia disorder and normal one

| Specifically, the groups | Number | The mean motions | Standard deviation | Standard error of difference | The significance level |
|--------------------------|-------------|------------------|--------------------|------------------------------|------------------------|
| Normal | 20 students | 1607/42 | 7391/2 | 5137/0 | 05/0 |
| Group of dysgraphia | 20 students | 5313/20 | 3518/2 | 8126/0 | 05/0 |

127. In the last part of the study the comparison of flexibility and complexity movements between the two groups was performed, the movements included (touching nose with fingers, feet and toes rhythmic beats, alternative opening and closing of the hands and feet, punctuation, beating with speed punctuation, displacement the coins and matches and passing them through mazes, beating with feet and drawing a circle with fingers, opening and closing hands, wrapping the threads around bobbin on walking). Table 5 present the statistical comparison of flexibility and complexity, the value of T-test is $T(38)=4/750$.

DISCUSSION AND CONCLUSIONS

130. According to the acquired results of the study subjects with dysgraphical disorder in the gross movements, fine movements, balancing and harmony, and flexibility and complexity have problems. Individual with dysgraphia haven't good progress in the sport, and they may be omitted from sport team because they cannot obey and follow the coach order properly. In this study subjects with dysgraphia disorder have more problems compare to the normal ones.

131. As you saw in the table 3 subjects with dysgraphia have more problems in the fine motor activities and these problems can caused educational failing. Other problems of students with dysgraphia is inappropriate social behavior, problems and limitations in the understanding of time and money, and difficulty in retrieving information from the brain, and also these children will experience more problems in the fine motor activities.

132. These functions have a direct impact on the motor control. One of the characteristic of children with dysgraphia disorder that may interfere with cognitive functions is selecting, familiarization, implementing (controlling the cognitive complex functions and response control) and executive functions are considered with self monitoring movements broadly.

133. The results from Table 5 compare the flexibility of movement between the two groups and shows the differences of these groups.

134. Children with dysgraphia in the regulation of movements have more problems than normal children; in addition these children in verbal learning, motor planning and organizing are also weak. (10)

135. Children with dysgraphia by considering social necessities in the regulation or inhibition are incapable and quick modifying of motor activities are difficult for them. Base on the acquired results we can see the lack of motor control in the students with dysgraphia. Subjects in spite of having healthy limbs cannot accomplish the orders and suffer from lack of balances. It has been suggested that teaching effective method to the children can lead to the positive results. Organizing and planning the practical activities can be effective step toward increasing the skills and motor control in the schools.

136. In spite of significant positive aspects of cognitive training its efficacy has not been approved for these children considerably. Because these children from developmental dimension haven't domination on the cognitive and Meta cognitive function, so parental training with restorative and compensatory treatment is more effective. (11)

Arnold Gezel believed that motor skills are genetic program, but now psychologists say that motor developments are not merely the result of nature or nurture. Today's researches axis is switching from the description of creating motor skills to the state of formation the motor skills. Psychologists also believe that these motor and perceptual skills are interrelated. Children constantly coordinate their movements with incoming information of their senses in order to reach balance, grasping the tools in the space and walking on the different surfaces of the ground. Moving at the same time caused the perception process (12).

Segal and et al (1983) compared normal students with students who have dysgraphia disorder. Children with writing disabilities have significant weakness in the writing skills, motor skills, eye-hand coordination compare to the normal children. In the Azad and et al study (2007) Children with dysgraphia have significant weakness in the power, hand motor skills and probably this issue is the reason of their weakness in the handwriting skills.

139. Children in the age of 6 acquire essential skills for writing completely (Kise-Smith, 2001). Children with dysgraphia spend considerable time for writing and have problem in legible writing. In this study writing disorders from neural development perspective in the school-age children have been investigated. All of the 99 students with dysgraphia at least have one problem in the (fine motor, creating visual-spatial relationships, sequence of motion and strength) (Sender et al., 1992).

140. Fine motor skills may caused writing disorder (Paaske, 1995) children with dysgraphia have trouble on the hand function especially finer movements (Aoyer and Brown, 1989).

141. For compensating the problem of motor skills different approaches have been presented which we will mentioned some of them here: Hyper excitement level caused performance decreasing, fine motor control downfall, creating major changes in the information processing and perceptual limitation. Human behavior and all central nerves system activities are under the efficacy of sensational system and will have objective form by muscular activity. The dimension of this disorder is different according the age and development of individual for example young children may not have necessary skill for reaching to the important motor ability in the development (like crawling, walking, knotting shoes thread, button in) but older children in the motor dimension(like building model, playing with ball, drawing and writing) have problem.

142. It is now accepted that the integrity of the motor methods are the foundation of reaching satisfactory movement . some time we observed that individual want to collect information systemically and implement the movement accurately but they face challenges and will have unordered movements, in this case organizing problem will come out , it means that children have no problem in their muscles but the pathological due to executive function lead to creating this problem. The task of therapist is to focus on behavioral management because the distance of actual power and potential power should reached to the zero and therapist by training should move toward planning and organizing. For achieving child success the most important principle is that we should be aware of positive and negative points of child then the repetition and practice, cooperation between teachers and parents, and using supportive sources out of educational environment is the necessities of treatment process

Appreciation

We here greatly thank families and school students of Tehran province who friendly have cooperation with us.

REFERENCES

- Azad, A, Havaei, N, Rafie, Sh, Kayhan, M (2007). Comparison of motor- sensory skills of children with dysgraphia and normal ones age from 9-11. *Modern rehabilitation*, Rehabilitation Faculty. Tehran University of Medical Sciences. 1 (4), 5-1.
- MackLaughlin, James and Wallace, Gerald, (Bita). *Learning disabilities*, translated by Munshi Muhammad Taqi al (1991). Publication of Astan Quds Razavi.
- References*
- Adams · John W., Snowling · Margaret J. (2001). Executive function and reading impairments in children reported by their teachers as 'hyperactive'. *British Journal of Developmental Psychology*. 19 (2), 293-306
- Alizade H. *Attention deficit-hyperactivity disorder*. Tehran; Roshd Publications 2004.p.75
- Barkley R. *A handbook for diagnosis and treatment of ADHD and the nature of self control*. Newyork; Guilford 1997.p.555.
- Case smith. J., *Occupatio Mosby Louis CV; .2001nal Therapy for children*. 4 ed. st, 285-545.
- Fallahchai R. 1995. *The survey dyslexia and dysgraphia in elementary students [MSc Thesis]*. Tehran, Iran: School of Psychology, Tarbiat Modares University ;. [In Persian]
- Horne WF, Lalango N, Greenberg G. Additive effects of behavioral parent training and self-control therapy with ADHD children. *J of Clinical Child Psychology* 1998; 108.
- Joseph M, Stray Horn IR. Self control theory Psychiatric. *J of the American Academy of Child And adolescent* 2002: 11-17.
- Key, Margaret. J. (2006). *Diagnosis and intervention strategies for disorders of written language*. Avalabeat: <http://www.Udel.Edu/bkirby/asperger/disgnuphia-mykey.Htm/>
- Lame. LL (1979). Handwriting in an early childhood curriculum. *Yong children*. 35 (1), 20-27.
- Mchale, K and Cermak. S. (1992). Fine motor activities in elementary school: Preliminary. Finding and provisional implications for children with fine motor Problems. *American journal of occupational therapy*. 46, 898.
- Newman, Renee. M. (1999). *Dygvuphia: causes and treatment*, Henderson, Michigan. USA.
- Nicholi AM Jr. *The adolescent: the Harvard guide to modern Psychitry*. London; Belnap 1978.p.39.
- Ohere AE, Brown JK, *Childhood dysgraphia part2. A study of hand function child care Health Development*. 1989, 15 (3), 151-166.
- Pehosk C. *Central nervous system control of precision movement of the hand*. *A m Journal occupation* 1995; 54, 810-815.
- Perron & Perron. *Clinical Psychology and diagnosis: testing and diagnosis*. Dadsetan and Mansour, editors. Tehran; Beasat Publications 1384.p.125.
- Robert M, Roth PhP. *Executive dysfunction in attention - deficit hyperactivity disorder cognitive and neuromaging findings*. *Psychiatric Clinics of North America* 2004: 83-96.
- Santraock J. *Introduction to psychology*. Firozbakht M, editor. Tehran; Rasa Publication 2003.p.189-190.
- Sandler. A D., Watson TE, Foote. M., Lerine. MD, Coleman WL, Hoop. SR, *Neurodevelopment study of writing disorders in middle childhood*. *Journal Behaviour* 1992, 131, - 17-23.
- Seif S. *Specific learning disorder*. Tehran; Samt Publications 1995.p.22-3.
- Seif Naragi M & Naderi E. *Learning disability 'testing and diagnosis*. Tehran; Mekyal Publications 2002.p.120-2
- Siegal L. S, Feklman W. *Nondyslexic children with combined writing and aritmetics learning disabilities*. 1983, 22 (4) 241-441.
- Werner & Riny. *Perceptual-mtor dvelopment equipment ieas & ativiies sazmand A & tabatabai M, editors*. Tehran Danje Publications 2000 .p.7-8.
- Werner & Riny. *Perceptual-mtor dvelopment equipment ieas & ativiies sazmand A & tabatabai M, editors*. Tehran Danje Publications 2000 .p.161
- Wechsler D. *Wechsler Intel ligenca scales for children-revi sed*. Trans. Shahim S. 4 th ed. Shiraz Iran: Shiraz University Publication; 2006. 20.