Assessing the Effectiveness of Holistic Multidimensional Treatment Model (*Hojjati Model*) on Receptive and Expressive Language Skills in Autistic Children

*Maryam Hodjati[1], Maryam Khalilkhaneh[2]

[1]Noor Hedayat School, Mashhad, Iran.
[2]Department of Linguistics, Ferdowsi University of Mashhad, Mashhad, Iran.

Abstract

Background: Autism as part of the category called Autism spectrum disorder (ASD), is caused by disorders in brain and nervous network and characterized by defect in social behavior, language and cognition. This study aimed to investigate receptive and expressive language performance and the severity of the disorder in 30 children with autism aged 2-8 years who speak in Persian language.

Materials and Methods

In this cross-sectional study 30 children with autism were selected using random sampling method. The study tools included "The Childhood Autism Rating Scale (CARS)", and "Newsha Developmental Scale (NDS)" for assessing the receptive - expressive language skills. In order to assess the level of language impairment in subjects, the participants were divided into 5 groups with 6 people (considering the speaking ability including sign language and speech), with equal number of boys and girls (3 girls and 3 boys) in each group. All of these children were evaluated by pediatric psychiatry, pediatric neurologist and pediatrician and were assessed according to the criteria for autism based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). Eventually, the data were analyzed using descriptive and inferential statistics in SPSS version 16.0 software.

Results

The results showed that there was a significant difference between the mean (standard deviation) and scores of receptive – expressive language skills in autistic subjects in each of the groups (P<0.05). In other words, there is a substantial difference in the mean scores of subscales of Newsha developmental scale with the scores of the subjects. Results also revealed that the processes of language development in subjects improved gradually during the treatment period.

Conclusion

Altogether, it can be said that the HMTM treatment method (*Hojjati Model*) which is derived from Iranian traditional medicine and holistic philosophy, can be effective in the treatment of language disorder in children with autism.

Key Words: Autistic Children, Expressive language, Holistic Multidimensional Treatment Model, Receptive language.

Corresponding Author:

Dr. Maryam Hojjati, Head of the Rehabilitation Center of Noor Hedayat, Mashhad, Iran.

Email: Hojjati_37@yahoo.com

1- INTRODUCTION

Autism is a communicative-cognitive disorder that is part of the category called Autism spectrum disorder (ASD). Although the autism is considered as a biological disorder, but still the genes related to this disorder has not yet fully recognized (1- 7). Since the main sign of autism is inability to communicate with others, different theory and hypothesis has been raised on the causes of this disorder. The current evidences show that damages to the central nervous system are the cause of behaviors of children in autism spectrum. It has been shown that there are abnormalities in specific regions of the brain such as frontal and parietal parts, cerebellum, amygdala and hippocampus region in autistic children (8, 9).

Moreover, several studies indicated that although the produced screams and phonations is the results of stimulation in different cores of limbic system, but after cingulate, amygdala is the most active part of the limbic system in sound production that this part shows a specific disorder in autistic people. According to the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-V), 50% of these children do not reach to developmental milestonesfor speaking or they have limited abilities in this regard (10- 13).

Furthermore, the studies show that a large number of emotional sounds in humans are produced as a result of amygdala stimulation. In addition, as the amygdala has a close connection with other auditory areas, such as the thalamus and vestibular nuclei, thus is able to give immediate responses. Because the damage in the right amygdala destroys the ability for rhythmic speech, therefore the ability to understand and respond to the social sounds, also becomes impaired in human. Meanwhile, the abnormal electrophysiology in autistic people is associated with the cortical areas of the brain that are responsible for

auditory processing of the word (14-16). Besides, recent studies of cognitive theories for finding a relationship between brain and behavior in autistic children demonstrated that functions including planning, working memory, impulse control and mental flexibility that are associated with the function of frontal lobe and prefrontal cortex, are also impaired in autistic children. These disorders can be mostly observed in daily behavior of autistic people such as repetitive behaviors, weakness to start or continue a new action, more tendencies towards the earlier works, and repetitive behaviors in daily life. According to the neuropathology and neuropsychology studies, prefrontal cortex plays an important role in autism (17- 19).

The other symptoms of autism include loneliness, lack of interest in social interaction, inability to provide appropriate physical gestures, developmental delay, frequent repetition of set words, pronoun reversal (for example using the pronoun "You" instead of "I"), monotonous sound and speech, stereotyped behaviors, emotional and cognitive problems, reduced attention, cognitive restrictions (minor to severe), and defects in developing theory of mind (20, 21).

The viewpoint that mental experiences are formed by physical states of the nervous system has been proved. It has also been accepted that mental theory or mind reading means that at some developmental stages the children become aware of their own or other people's beliefs, tendencies and mental status and are able to more easily predict their own or other people behavior. In light of conducted researches, many of studies have come to the same conclusion that many of children with ASD, language and intellectual retardation, have impairment in the development of theory of mind. Several studieson children with ASD and developmental language disorders have revealed the correlation

between language and development of theory of mind (22-24). Furthermore, recent studies regarded the disorder in mirror neuron system of the brain as an obstacle in autistic children for communication and the ability to mimic. According to the "Theory of Language and Mind", the impairment in the development of this theory is the cause of autism in these children. The reduced attention and frequent repetition of set words or whispering with no words, can be also correlated together. This disorder in addition to being physically harmful, can also be the cause of impairment in social skills (25, 26).

It should be noted that speech is defined by production of sound (voice), and fluency of communicative language and includes speech disorders such as stuttering, apraxia of speech, and phonological and nasal disorders. In such situation, the person has difficulty to produce language sounds, and is unable to produce fluent and correct words, or while producing the word has kind of problems that causes the listener not to correctly understand the person's speech (27). Since the language is a social contract that is used by speakers of a linguistic community, it involves the words meaning, words morphology, syntax, sound and pragmatic use of word and sentence in different context and disorder in any of them can cause apraxia of speech. When a person has problem in understanding others, the person has receptive language disorder, and if the person has difficulty in expression of thoughts, ideas, desires and needs he has expressive language disorder. Autistic children due to cognitive impairment suffer from both disorders (28).

According to the studies, 25% of these children have language problems that the incidence rate is 4 to 5 time higher in boy than girls. The major symptoms include the impaired speech understanding, auditory processing and dyslexia, inability

to decipher the speech of others, inability to express thoughts verbally, defects in the application of correct and efficient words in conversation, weakness in nonverbal cognitive abilities and word selection skills and expressive language disorder (29, 30).

Even though there has been numerous reports regarding the language disorder in autism, but there is scant experimental and clinical researches about that. One of the most basic pivots of the discussion on the language and its exterior manifestation "Speech" is the relationship between speech and brain mechanism of the movement. The latest findings in neuroscience field that brought about a substantial transformation in the scientific understanding of the communication phenomenon, empathy and imitation is the discovery of mirror neurons. Mirror neurons can be an explanation for imitation, observational learning, empathy, perception and mind reading; hence, they have attracted the attentions of scientist in the area of autism spectrum disorders. This discovery raised the hypothesis of the association between developmental disorder and the function of mirror neurons as well as the cause of problems of autistic people regarding imitation, mind reading and language development. The studies conducted in recent years, confirm that development of mirror neurons can appropriately explain the process behind the emergence of language in human species (31- 36).

Considering the above facts, it can be said that imitation, which is associated with cognitive development and verbal ability, is impaired in the children with autism. This now raise a question that how is the process of language development (both verbally and non-verbally) in autistic children? Considering these facts, this study aimed to investigate the language skills in the groups of autistic children aged 2-8 years, Mashhad- Iran.

2- MATERIALS AND METHODS

2.1. Study design

This cross-sectional study was performed in one step and over a 3-month period in 2015. The aim of this study was to evaluate the effectiveness of Holistic Multidimensional Treatment Model (HMTM), which is based on the cybernetic approach, in improving the speech of autistic children (37-39). Theoretical approach to this hypothesis is in a way that physiological, cognitive and emotional systems, are associated together in a continuous two-way connection. This method consists of eight pillars that emphasis on (1) the motion perception, and (2) speech and language are considered two of those pillars. Having the knowledge about how this approach works and its effectiveness on improving language skills, can provide guidelines for therapeutic protocols for improving the theory of mind in children with language disorders. The ability of language production was assessed in 5 groups of autism patients using Holistic Multidimensional Treatment Model. Based on the inclusion criteria a total of 30 children were enrolled in the study. These groups of children was randomly selected from the rehabilitation center in Mashhad, North East of Iran.

2-2. Inclusion criteria

The inclusion criteria were as follows:

- Age range 2-8 years,
- Children diagnosed with autism,
- Having the ability to imitate at least one movement such as clapping or shaking hands,
- Having normal hearing threshold (based on the audiometric test results),
- Having clear vision (based on the optometrist assessment).

Considering these criteria, the children who diagnosed with autism by pediatric psychiatrist and pediatric neurologist were selected and then the autism symptoms were assessed based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). The assessment was conducted by watching the child and through interview with parents, and then based on the results the children who met the inclusion criteria were enrolled in the study.

2-3. Sample size

The study population in this study were 30 children with autism. Among autistic children, 5 groups with 6 people were selected with the equal gender distribution.

2-4. Method

In this study, assessment test was performed on 30 children with autism (15 girls and 15 boys in 5 groups with 6 people), aged between 2 to 8 years with Persian language in the Noure-Hedayat Autism Training Center in Mashhad city, North East of Iran. All of the subjects in these groups, had been practically under training by HMTM method. Initially the score of Childhood Autism Rating Scale (CARS) (40) was obtained in order to better understand the level of disorders in each of the subjects and then by dividing the same groups, the level of disorder detected in each of the skills based on the Newsha developmental scale (41).

So that in the first group, the children without speech; in the second group, the children without verbal language who were able to express their purpose through sign language (gesture); in the third group, the children who were only able to produce single word vocabulary; in the fourth group, the children who were able to produce two- word phrases, and in the fifth group, the children who were able to produce full sentences were selected. There was equal number of girls and boys in each group. In addition, the values less than 0.05 were considered significant.

2-4-1. Newsha developmental scale (NDS) (41)

NDS which was used in this study is a valid test for assessing different aspects of development. This scale assesses seven hearing developmental skills including receptive language, expressive language, speech, cognition, social interaction and movement in Persian speaking children from birth and its validity and reliability have been proven by several studies (41). In this study, two subscales of this scale including receptive and expressive language skills were considered.

Each of the expressive and receptive language developmental skills was assessed in age ranges of 16 to 18 months (level- 6), 19 to 24 months (level- 7), 25 to 30 months (level- 8), 31 to 36 months (level- 9), 37 to 42 months (level- 10), 43 to 48 months (level- 11), 49 to 60 months (level- 12), and over 61 months (level- 13).

2-4-2. Holistic Multidimensional Treatment Model (HMTM) (37-39)

This study aimed to assess the level of influence of the new theory entitled holistic and multifaceted approach inspired by traditional medicine and perspective of Islamic-Iranian mysticism in the treatment of language disorder in ASD children. This approach is consisted of 8 pillars including: (1) emphasis on holistic view to the child (the principle of holism), (2) emphasis on the whole and part relationship and impartible impact they have on each other (the interaction principle), (3) emphasis on the principle of energies exchange, and creating deep and safe emotional connection and unconditional acceptance of the child by parents, educators and therapists (the field principle), (4) emphasis on the physiology of the child (physiology principle), (5) the emphasis on motion and perception, (6) the emphasis on speech and language, (7) emphasis on emotional, communication and game (performance) aspects, and (8)

emphasis on using techniques and training content based on the developmental trend in the form of parallel and group. The cybernetic perspective to HMTM, is based on the fact that different aspects of human existence are connected together and are inseparable of each other and the child should be considered as a whole with different aspects including physical, emotional, excitatory, and cognitive; and hence these aspects should be considered in parallel and simultaneously. Based on this approach and philosophy, each cell has independent thought that its capability and efficiency is only defined in the context of an organ, a limb or eventually a body and at the same time its existence depends on the whole body, a limb or an organ. According to HMTM approach, the aim of the speech is not the mere expression of words and sentences or the formation of speech in the child.

If only the expression of words to be considered as the language, then speech is the most important way of communication with external world and social environment and cybernetic information is hidden in the whole sentence and interaction between words. In this approach, considering that each message after passing through the emotional region should enter to the perception and subsequently cognition region, is based on the fact that the real learning cannot be achieved unless the complete understanding (perception) to be formed.

As the improvement and correction of movements can directly affect and modify perception and brain processing pace therefore, correct and semantic understanding of the messages that are received by brain, with movement can eventually improve brain processing and cognition. In HMTM, it is believed that because human is by nature a social animal, so a child with disorder has the capability of perception, learning, consolidation and expansion of the learned

subjects in the social environment and among peers. The factor that in this model causes the success and closeness of children to normal spectrum is the way of planning and spending time and parallel work for all needs of an autistic child. Hence, in this method the major portion of time is allocated to the training and fortifying the learned subjects in different areas in group, and only in some specific treatments such as speech therapy, occupational therapy or individual training (if required) the services are offered individually.

In HMTM (*Hojjati Model*), the child is assessed regarding the basic cognitional concepts and after cognitional assessments and clinical evaluations, the child based on the severity of defect in performance is placed in individual or group classes including 2, 3, 4, 5 or 6 people. Each child roughly spends 5 hours in the center and the duration of participation in the programs, based on the child performance, can be varied from a few days to a few weeks or to a few months (37-39).

3- RESULTS

This study was performed on 30 autistic children (15 boys and 15 girls), with an average age of 5.43 ±0.623 years old. The study variable was the score of subjects in Newsha developmental scale. To study the effectiveness of the above methods, 30 children with autism were divided into 5 groups with 6 people ranged from speechless children to children who were able to express a sentence.

As it can be seen in **Tables.1-10**, there was a significant difference in the mean scores of the test between the study groups compared to the standard scores (P<0.05).

Table-1: Results of the test obtained from the first group

Skills	Mean	SD	t-test	P-value
Receptive skill	4.67	2.07	-3.07	0.005
Expressive language skill	1.67	0.52	0.93	0.002

SD: Standard deviation.

Table-2: The standard scores of normal children

Skills	Mean	SD
Receptive skill	8.41	3.73
Expressive language skill	6.36	0.61

SD: Standard deviation.

Table-3: The results of the test obtained from the second group

Skills	Mean	SD	t-test	P-value
Receptive skill	3	0	0.44	0.002
Expressive language skill	0.83	0.41	-1.77	0.001

SD: Standard deviation.

Table-4: The standard scores of normal children

Skills	Mean	SD
Receptive skill	4.86	2.56
Expressive language skill	3.44	2.90

SD: Standard deviation.

Table-5: The results of the test obtained from the third group

Skills	Mean	SD	t-test	P-value
Receptive skill	5.33	1.63	-8.81	0.001
Expressive language skill	0.50	0.55	-7.09	0.001

SD: Standard deviation.

Table-6: The standard scores of normal children

Skills	Mean	SD
Receptive skill	6.43	2.56
Expressive language skill	4.35	2.90

SD: Standard deviation.

Table-7: The results of the test obtained from the fourth group

Skills	Mean	SD	t-test	P-value
Receptive skill	4.33	1.75	-1.67	0.001
Expressive language skill	1.33	0.52	-2.06	0.005

SD: Standard deviation.

Table-8: The standard scores of normal children

Skills	Mean	SD
Receptive skill	5.68	2.10
Expressive language skill	2.35	1.92

SD: Standard deviation.

Table-9: The results of the test obtained from the fifth group

Skills	Mean	SD	t-test	P-value
Receptive skill	3	0	-2.21	0.005
Expressive language skill	0.83	0.05	-2.26	0.005

SD: Standard deviation.

Table-10: The standard scores of normal children

Skills	Mean	SD
Receptive skill	8.41	2.36
Expressive language skill	3.36	1.14

SD: Standard deviation.

4- DISCUSSION

The results of this study are consistent and in line with the results of previous studies conducted on different languages (23-25, 37-39). Our findings indicate a substantial defect in non-verbal imitative skills as well as verbal skills including receptive- expressive language skills in autistic children; because non-verbal communication consists of gesture, eye contact, face posture, position of the body and tone of speech, therefore these factors were considered in the evaluation of autistic children in this experiment.

The ability to understand and express non-verbal communication is considered as a powerful tool for interaction, expression of purpose, guiding difficult situations and creating effective communication. The body language experts believe that the tone of the speech is as important as semantic stimulus for perception and expression of emotions. Several studies have shown that Electroencephalography (EEG) oscillations in the frequency of 8-13 Hz (capillary waves), on sensory-motor cortex of the brain reflects the function of mirror neurons and the impairment in this function is completely obvious in autistic people (31-36).

The results of this study in accordance with the previous researches on the brain of autistic children indicate that imitative, movement, and sign language trainings can be used for improving the function of mirror neuron system. This can facilitate the language and then speech skills and speech production in autistic children. According to the previous studies and HMTM theory, this can confirm the hypothesis of the study which is based on all behaviors and movements. The movements are the results of the transmission of the messages from the brain that cause the brain to send commands to the muscles and limbs that as a result movement occurs (**Tables 1-10**).

The findings of this study supports the relationship between limb movement, in particular the use of gesture in improving the retrieval of verbal information and thus is in line with other studies and supports them (37- 39). Moreover, it can be said that the recorded figures in this study, **Figures.1-4**, that present the effectiveness of aforementioned method in the subjects, can highlight the necessity of HMTM method on the improvement process of perception and language production in children with autism.
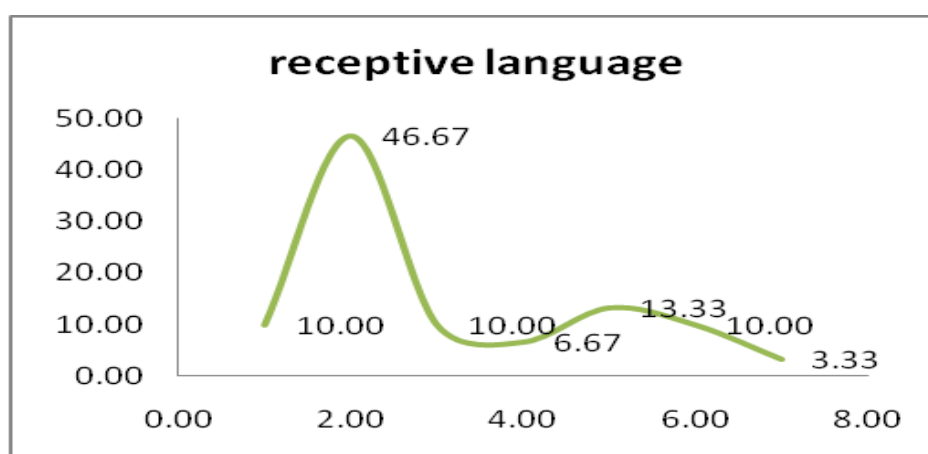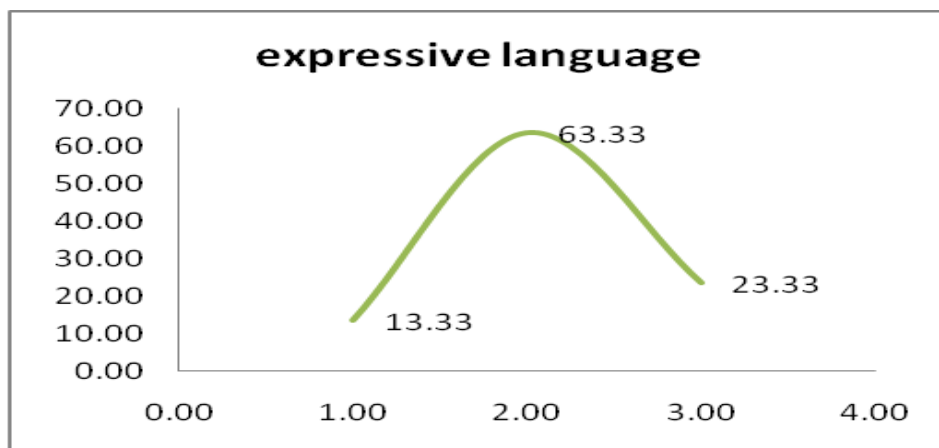

Fig.1: Growth trend of receptive skill in in subjects

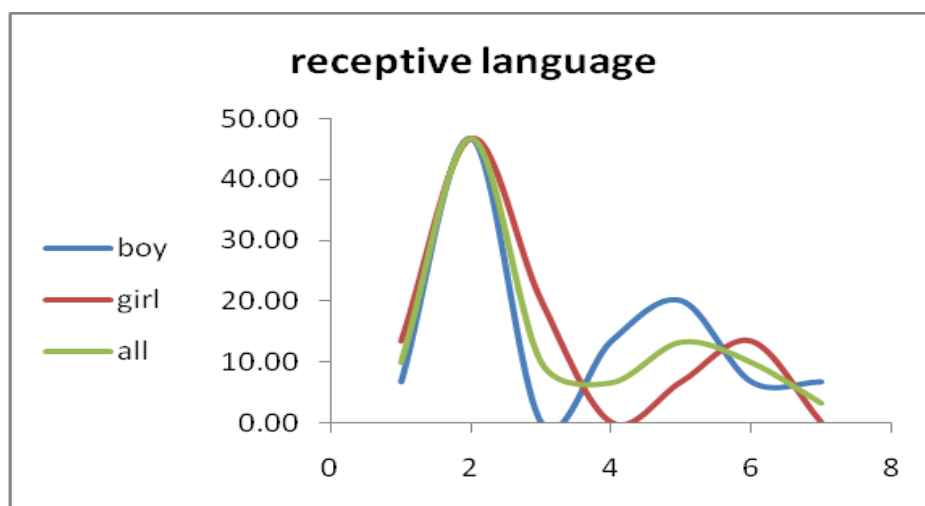**Fig.2**: Growth trend of expressive skill in subjects

Fig.3: Growth trend of receptive skill in subjects based on gender distribution
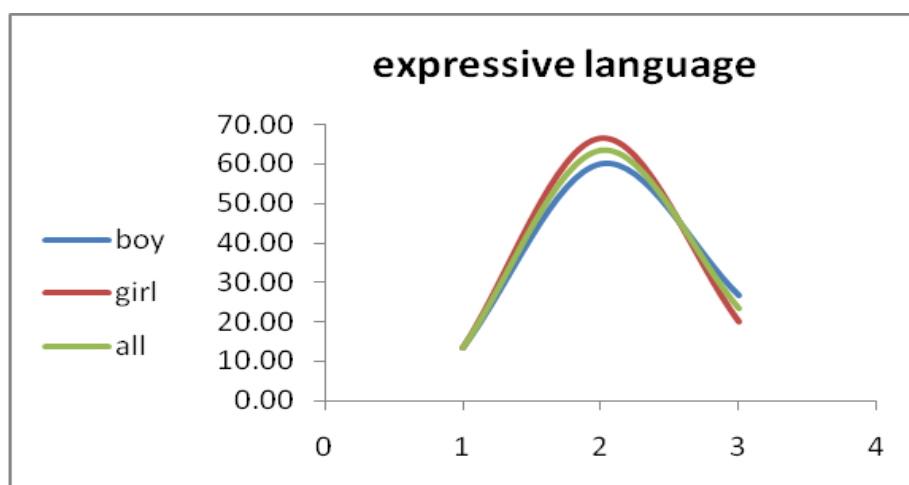

Fig.4: Growth trend of expressive skill in subjects based on gender distribution

Considering the statistical tests and the scores in different groups, it can be said that intervention and treatment leads to the perceptive capability and language production in subjects groups. Therefore, it seems that intervention courses and the duration of HMTM intervention (*Hodjati Model*) causes time-dependent improvement in the abilities of autistic children and profoundly affected the findings of the study.

5- CONCLUSION

The results of this study indicate that autistic children have serious defect in non-verbal and gesture skills as well as verbal receptive and expressive skills, and thus intervention training can help improve the speech in these children. Hence, it can be said that HMTM approach (*Hojjati Model*) can have a suitable and effective application in the treatment of these children.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. Lauritsen M, Ewald H. The genetics of autism. Journal of Psychiatry 2001; 103(9): 411-27.

2. Remschmidt H. Die bedeutung genetischer Faktoren für die Ätiologie des frühkindlichen Autismus , Journal of Autismus 2000; 30: 16-24.

3. Smidt J, Heiser P, Dempfle A, Konrad K, Hemminger U, Halbach A, et al. Formal genetic findings in attention-deficit/hyperactivity disorder, Journal of Psychiatry 2003; 41: 1026-36.

4. Walther JU. Genetik in der Kinder mit Autismus. Journal of Kinderpsychiatrie 2001; 7(3): 11-21.

5. Combi R, Redaelli S, Beghi M, Clerici M, Cornaggia CM, Dalprà L. Clinical and genetic evaluation of a family showing both autism and epilepsy. Brain Res Bull 2010; 82(1-2): 25-8.

6. Simmons DR, Robertson AE, McKay LS, Toal E, McAleer P, Pollick FE. Vision in autism spectrum disorders. Vision Res 2009; 49(22): 2705-39.

7. Santangelo S, Tsatsanis K. What is known about autism: genes, brain and bahaviour. Journal of Pharmacogenomics 2005; 5: 71-92.

8. Pintomartin J, Levy SE. Early diagnosis of Autism spectrum disorders, Journal of neurobiology 2004; 101: 344-54.

9. Smalley S, newdelman J, Gordon E, Kim T, Liu A. Genetic linkage of attention-deficit/hyperactivity disorder on chromosom 16p13, in a region implicated in autism. Journal of Genetic 2002; 71: 959-63.

10. Itahashi T, Yamada T, Nakamura M, Watanabe H, Yamagata B, Jimbo D, et al. Linked alterations in gray and white matter morphology in adults with high-functioning autism spectrum disorder: A multimodal brain imaging study. Neuroimage Clin 2014; 7: 155-69.

11. Lefebvre A, Beggiato A, Bourgeron Th, Toro R. Neuroanatomical Diversity of Corpus Callosum and Brain Volume in Autism: Meta-analysis, Analysis of the Autism Brain Imaging Data Exchange Project, and Simulation. Biological Psychiatry 2015; 78:126–34.

12. Gilberg C. Chromosomal disorders and autism, Journal of autism developmental disorders. 2001: 28: 415-25.

13. Harris G, Chabris Ch, Clark J, Urban T, Aharon I, Candouris K. Brain activation during semantic processing in autism spectrum disorders. Journal of brain and cognition 2006, 61: 54-68.

14. Wong V, Wong S. Brainstem auditory evoked potential study of autistic and normal children. Journal of child psychology 1991; 20: 29-46.

15. Ozonoff S, Progers S, Hendren R. Autism spectrum disorder. New York: American Psychiatric publishing; 2007.

16. Samson F, Zeffiro TA, Doyon J, Benali H, Mottron L. Speech acquisition predicts regions of enhanced cortical response to auditory stimulation in autism spectrum individuals. J Psychiatr Res 2015; 68: 285-92.

17. Jolliffe T, Baron-Cohen S. A test of central coherence theory: linguistic processing in high-functioning adults with autism or Asperger syndrome: is local coherence impaired? J of Cognition 199; 71: 149–85.

18. Manolitsi M, Botting N. Language abilities in children with autism and language impairment: using narrative as an additional source of clinical information. Child Language Teaching and Therapy 2011; 27(1) 39–55.

19. Melogno S, Antonietta Pinto M, Levi G. Profile of the linguistic and metalinguistic abilities of a gifted child with autism spectrum disorder: A case study, Child Language Teaching and Therapy 2015; 31(1): 113–26.

20. Anderson MP, Hooker B, Herbert MR. Bridging from Cells to Cognition in Autism Pathophysiology: Biological Pathways to Defective Brain Function and Plasticity. American Journal of Biochemistry and Biotechnology 2008; 4(2): 167-76.

21. Anagnostou E, Jones N, Huerta M, Halladay AK, Wang P, Scahill L, et al. Measuring social communication behaviors as a treatment endpoint in individuals with autism spectrum disorder. Autism 2015; 19(5): 622–36.

22. Rajendran G, Mitchel P. Cognitive theories of autism, Journal of developmental Review 2007; 27: 224-60.

23. Frye R, Beachamp M. Receptive language organization in high-functioning autism. J of Neurology 2009; 24(5): 231-6.

24. Küpperfahrenberg B. Autistische Kinder in der Regelschule: bericht über die Kooperation der Comenius- Schule, Schule für Geistigbehinderte mit Regelschulen. Journal of Pädagogische Fördeung von kindern und Jugendlichen mit autismus 2000; 17: 68-79.

25. Wisdom SN, J. Dyck M, P. Piek J, Hay D, Hallmayer J. Can autism, language and coordination disorders be differentiated based on ability profiles? Eur Child Adolesc Psychiatry 2007; 16:178–86.

26. Sigan L, Hartley SL, G. Robert Buckendorf GR, Haines K, Hall TA, Sikora DA. The Oral and Written Language Scales: Is it useful for older children with autism spectrum disorder? Research in Autism Spectrum Disorders 2008; 2:137–46.

27. Bishop D. Autism, executive functions and theory of mind: a neuropsychological perspective. Journal of child psychology and Psychiatry 1993; 34: 279-97.

28. Loukusa S, Leinonen E, Jussila K, Mattila M. Use of context in pragmatic language comprehension by children with Asperger syndrom and high-functioning Autism. Journal of Autism 2007; 37: 1049-59.

29. Levy Y, Yuda Ch. Language performance in silbing of noneverbal children with autism. Journal of autism 2001; 101: 344-54.

30. Matson J, Mah S, Hess J, Fodstad J, Neal D. Convergent validity of autism spectrum-diagnostic for children(ASD-DC) and childhood Autism Rating Scale (CARS), Journal of research in autism spectrum disorders 2010; 4: 633-41.

31. Oberman L, Hubbard E, McCleery I, Altschuler E, RamaChandran M, Pineda J. EEG evidence for mirror neuron dysfunction in autism spectrum disorders. Cognitive Brain Research 2005; 24(4): 190-8.

32. Dunn MA, Bates JC. Developmental Change in Neutral Processing of Words by Children with Autism. J Autism Dev Disord 2005; 35(3):361-76.

34. C. Corballis M. Language as gesture. Human Movement Science 2009; 28: 556–65.

35. Bates E, Dick F. Language, Gesture, and the Developing Brain. Developmental Psychobiology 2002; 40: 293-310.

36. L. Rowe M, Goldin-Meadow S. Early gesture selectively predicts later language learning. Dev Sci. 2009; 12(1): 182–7.

37. Hojjati M. The Effectiveness of Holistic Multi-dimensional Treatment Model (HMTM) in the Treatment of Children with Autism Spectrum Disorder (ASD). Int J Pediatr 2014; 2: 125-32.

38. Hojjati M. Comparison of the Effectiveness of Holistic Multidimensional Treatment Model (HMTM) and Applied

33. Gentilucci M, C. Corballis M. From manual gesture to speech: A gradual transition. Neuroscience and Biobehavioral Reviews 2006; 30: 949–60.

Behavioral Analysis Approach (ABA) in Treatment of Children with ASD. Journal of Clinical Psychology 2010; 2(6): 27-35.

39. Hojjati M, Sadeghi Bejestani GH, Ashrafzadeh F. Investigation on the Effectiveness of Holistic Multi-dimensional Treatment Model (HMTM) in Improvement of CARS Test Indicators in Autistic Children. Int J Pediatr 20145; 16: 543-53.

40. Childhood Autism rating Scale-Second Edition (CARS-2). Education Service Center: Texas Education Agency; August 2015.

41. Malayeri S, Jafari Z, Ashayeri H. Newsha Developmental Scale. Tehran: Danjeh publishing; 2010.