

Investigation on the Effectiveness of Holistic Multi-dimensional Treatment Model (HMTM) in Improvement of CARS Test Indicators in Children suffering from Autism Spectrum Disorder

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Abstract

Introduction

The goal of research is investigation on the effectiveness of Holistic Multi-dimensional Treatment Model (HMTM) in improvement of CARS test indicators in children with Autism Spectrum Disorder (ASD) and it is done without pharmaceutical interventions, without names and accompanied by parental satisfaction questionnaire.

Materials and Methods

In this study with purposeful sampling method, 60 autistic children chosen randomly among 6-10 year-old patients were taken one year observation. At the beginning of this research they were taken the CARS pre-test and then in each month the complete behavioral HMTM checklist and the CARS test was taken. Observing HMTM treatment model, includes intuitive checklist with the aim of intuitive adjustment, abnormal behaviors checklist with the aim of decreasing them, individual behaviors checklist with the aim of increasing them and emotional interactive behaviors checklist with the aim of improvement that are conducted in statistical tables.

Results

Results shown a positive impact of HMTM in treatment trend of autism spectrum disorder considering sum of CARS points, also the effect on each CARS test parameters and CARS parameters improvements are meaningful holistic approach in HMTM method has interpreted some vague CARS parameters furthermore ($P < 0.05$). The statistical properties of CARS test with HMTM treatment model, indicates that there was a high correlation coefficient and a significant relationship in behavior tables of HMTM and CARS test.

Conclusion

Holistic multi-dimensional treatment model has caused considerable and improvement children's individual interactions and intuitive balance.

Key Words: Autism, ASD, CARS test, Children, HMTM.

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Introduction

Autistic spectrum disorders (ASD) describe a range of conditions classified as neurodevelopmental disorders, which are known by deficit in communication, social interactions and presence of repetitive patterns in behavior, interests and activities(1). These features often appear in the childhood. Recent epidemiologic studies have estimated the prevalence of autism spectrum disorders as one in every 88 children(2). Despite extensive research, there is still much controversy about the morphological, functional and neurological characteristics of people with autistic brains (3, 4). However, the neural basis of behavior changes in ASD has remained largely unknown.

Autism is characterized with disorders in three main areas of social interaction, communication and behavior. Autism is a kind of developmental disorder characterized by abnormal communication and verbal behaviors. The symptoms of this disorder, which are more common in boys than in girls, appear in the first years of life, and the main cause is unknown.

In 1940, two scientists, an Austrian American psychiatrist and physician, Leo Connor, American psychiatrist and physicians, and an Austrian pediatrician, medical theorist, and medical professor, Hans Asperger, independently described a new neurodevelopmental disorder and incidentally both called the disorder with a similar name as autism syndrome (derived from the Greek word 'autos' meaning self). Presence and contact with mobile phones and other devices relying on wireless technology – due to creation of magnetic fields density - air pollution, genetic factors and maternal mental conditions during pregnancy are as causes of autism. The prevalence of autism spectrum disorders has

been much more reported in the developed countries. This remarkable increase in the prevalence of the disorder is attributed to the changes made in methods of detection and reporting rather than to be a real biological increase (5).

There are two ways to study a system: Top - down and bottom-up approaches (6). In the bottom-up approach, called as component-oriented method, it is believed that a system (here, the child) is made up of components that the study of these components will result in the recognition and understanding the whole. Today, many treatment methods are based on this idea. In the top-down method, which is called holism, it is supposed that the whole is more than just the sum of components, and to recognize a system, the interactions between components must also be considered in addition to the components themselves. The HMTM (Holistic multidimensional treatment model) method is based on this idea (7).

Materials and Methods

Research Tools

The diagnostic tools in this study specialized diagnosis by a Child and Adolescent Psychiatrist and a diagnosis by the Evaluation Organization of Special Education. Also, the CARS test was used as pre-test and post-test at the beginning and end of each month to determine the severity of the disease. To this end, each child has two test scores per month, and the rate of change in the relevant items is the scores difference that the child is given at the end of each year. The research tools include the following:

Multidimensional Holistic Treatment Model (MHTM)

This attitude has been formed through long-term direct experience with children with pervasive developmental disorder, and emphasizes on 6 axes:

1. Holistic view of the child;
2. Unconditional acceptance of the child and making a deep emotional connection between caregiver and child;
3. Physiology;
4. Movement & Perception;
5. Speech & Expression;
6. Affective, emotional, communicational and play aspects.

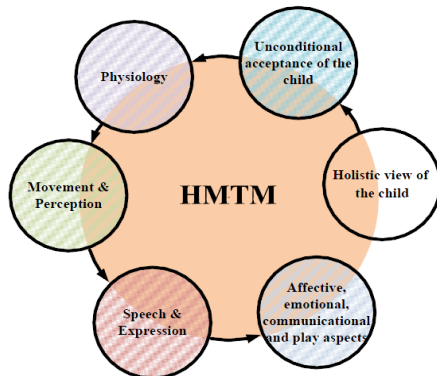


Fig.1: HMTM model

In this method (Figure.1), for evaluating the behavioral characteristics of the child, the child is examined and assessed in five areas of speech status, emotional and affective or engagement behaviors, senses, abnormal behaviors and individual behaviors. According to the test procedure, the relevant scores for the characteristics related to these five areas are recorded in each month, and finally, some graphs are plotted that can help to assess the treatment process. These charts that are given in the following were provided for 60 children with autism in four seasons of 2014; the patients' scores were extracted and used in the study (Fig 2).

CARS Test

This diagnostic and screening test for autism was developed and provided by Schopler in 1988 and has 15 items as follows:

1. Communication with people;
2. Imitation;
3. Bodily movements;
4. Emotional response;
5. Application of objects;
6. Adapt to changes;
7. Visual response;
8. Auditory response;
9. Response and use of taste, smell, and touch senses;
10. Fear or nervousness;
11. Verbal communication;
12. Non-verbal communication;
13. Function or activity level;
14. Level and stability of rational responses;
15. Overall impression (8-10).

Each item is scored in a seven-point grading scale. Low scores indicate the lower intensity of autism symptoms, while high scores indicate the severity of autism. Also, the scores sum on this scale indicates an overall score about the severity of autism spectrum disorders (Review of psychometric indices of autism diagnostic test). Each item includes the options of "No problem", "Little abnormal", "Moderate" and "Severe", which were given in order 1, 2, 3 and 4 scores. The total test score will be between 15 and 60 that regarding scores above 30, the diagnosis would be autism. The scores between 30 and to 36 indicate low to moderate autism, while scores between 36 and 60 reflect the severe autism (10).

Data analysis tools

Statistical methods of P-value and correlation coefficient were used to determine the psychometric indices of HMTM test such as significance level and reliability. Pearson product moment

correlation coefficient (r) is a method typically used to connect two quantitative variables. To calculate r, there must be at least two values (sizes) for each subject. It is often assumed that these two sizes should be at a distance level. The correlation coefficient can range from +1 to 0 and from 0 to -1. The value of +1 indicates a complete or positive correlation, and -1 indicates the complete and negative correlation.

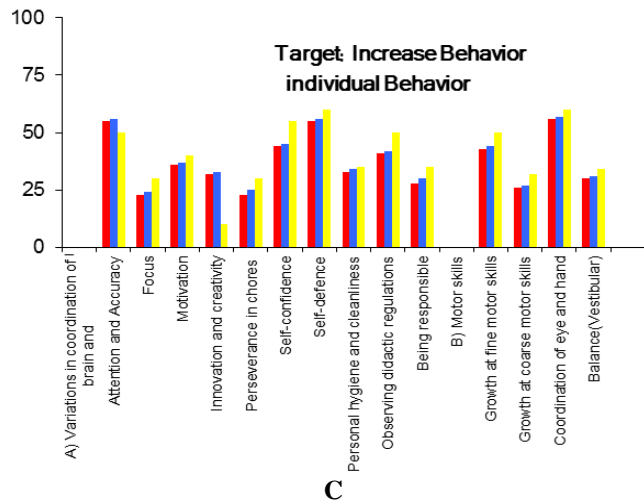
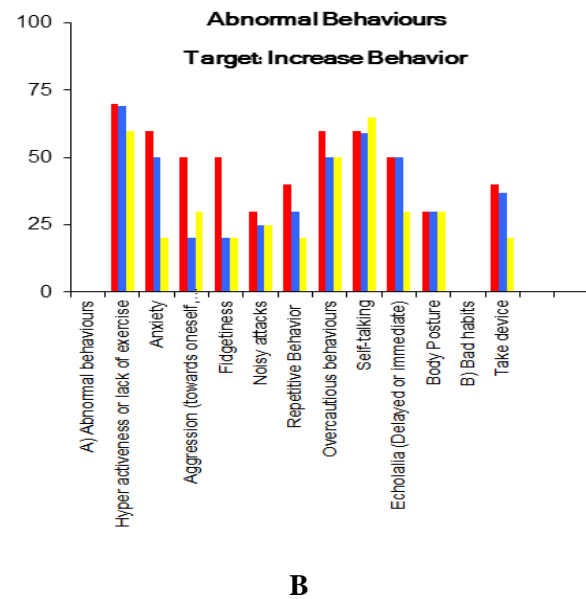
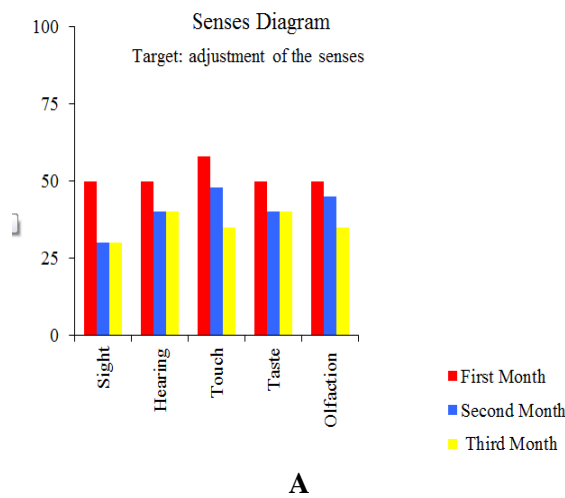


Fig 2: An example of HMTM behavioral checklist

A correlation coefficient of zero indicates that there is no correlation between the two variables. It must be however understood that there is rarely a full correlation between the two variables in the behavioral sciences(11, 12).

The correlation coefficient also describes the type of relationship, meaning a being negative or positive. If a negative value means when one variable increases, the other decreases. If the value is positive, it means that both variables are likely to increase or decrease (12).

Relationship or difference between variables can be examined through probability. The relationship or difference between two variables may be random. Therefore, the relationships or differences between variables should be examined according to the significant level. The minimum acceptable level is 95% probability. This means if a relationship or difference is seen between two variables and statistical calculations show that the relationship or difference is due to chance by 5% probability, and by 95%, the relationship or difference is non-randomized and arising from the impact of a trial practice, the

relationship or difference would be considered significant; or if the p-value is small, and represents a value of less than 0.05(12).

The standard deviation, as the most important dispersion index, was also used to demonstrate the scattering rate of data. Reporting the average value, without mentioning the variability or dispersion indices, will lead to misinterpretation of the data. The researchers tend to focus on measures of central tendency and neglect of their distribution pattern, while they are also equally important. The average of two data series may be the same, but their distribution would be different. If the distribution scores are similar, they would be called homogeneous (with low variability), and if the scores are not the same, they would be called heterogeneous (with high variability). Dispersion measures show the distribution rate or changes between the scores of a distribution(13, 14). Bar, pie and box graphs were also used to investigate the treatment trend.

Results

At first, the CARS data was divided As follows:

- Number 1: Indicates the absence of disease;
- Numbers between 1 and 2 indicate weak abnormality;
- Numbers between 2 and 3 indicate moderate abnormality;
- Numbers between 3 and 4 indicate severe abnormality.

In fact, by reduced CARS score in March 2014, one can say that improvement has occurred. Then, only the fear or nervousness features and the CARS overall scores were studied (Table 1).

Table 1: Comparison of fear or nervousness in the pre-test and post-test

Variables		Frequency		Percent	
		May	March	May	March
Fear or nervousness	Absence	0	0	0	0
	Weak	13	20	21.6	33.3
	Moderate	31	30	51.6	50
	Severe	16	10	26.6	16.6
	Total	60		100	

In Table 1, characteristics of fear or nervousness in May and March 2014 (pretest and posttest) were compared with each other. In (Fig 3), for each month, the frequency and frequency percentage was calculated, and the following bar graph was plotted.

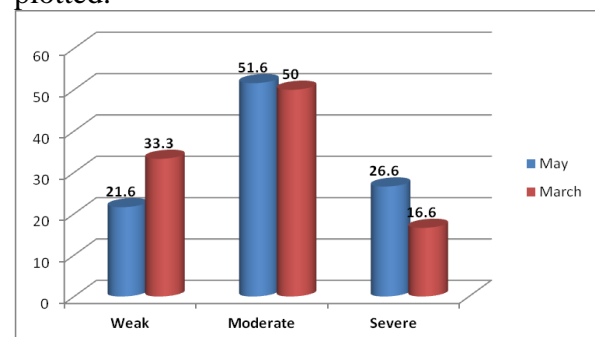


Fig 3: Comparison of frequency percentage distribution of characteristics of fear or nervousness in A: May and B: March

It can be concluded that in May, most of the children referred were moderately abnormal in this feature. Given that the decline in the children CARS scores in March compared to May indicates an improvement, it can be concluded regarding the characteristics of fear or nervousness, only the scores of children with moderate and severe abnormal disease levels have reduced, and transferred to the weak abnormal group. In contrast, the number of children with weak abnormal condition has increased. In the following, the box diagram of fear or nervousness changes were examined at the beginning and end of the study.

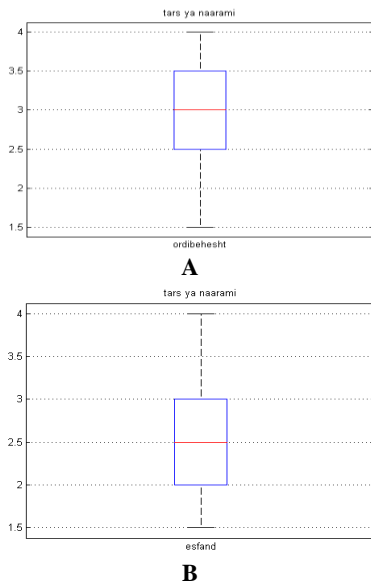


Fig 4: Box graphs for fear or nervousness feature: A. May, 2014; B. March, 2014

In (Fig 4), the box diagram shows that the distribution of data is symmetric. Given that the length of the rectangles in both months is the same, the scattering of data is the same as well. The lower mean in March indicates that 50% of data are less than 2.5, suggesting progress in the treatment trend.

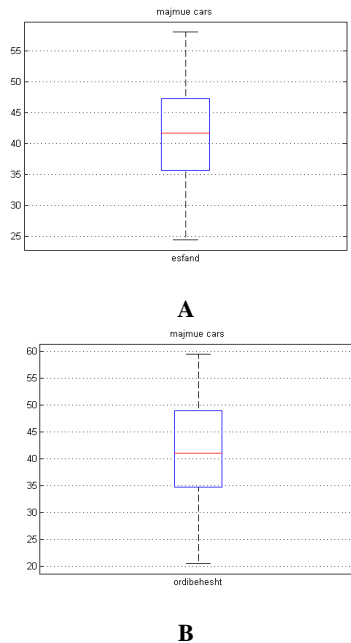


Fig 5: Box plots for the sum of CARS: A. May; B. March 2014

According to (Fig 5), one can conclude that the scattering of data in May is more than in March, and in March, the children CARS scores have decreased, showing an improvement in patients. Also in March, due to occurrence of mean in the middle of the rectangle, data distribution is more symmetrical than in May. Due to the lowered maximum in March compared to May, we can conclude that the CARS overall score of children has reduced, which represents the improvement in their condition.

Standard Deviation (SD)

The aim is to determine the distribution of data in each of the characteristics. Given that lower and closer to zero standard deviation value represents the higher congruence and similarity in the studied feature among the people, based on standard deviation results, we can say that the studied children with autism are similar in all CARS characteristics. However, the greatest similarity in March and May was seen in the level of activity, respectively as 0.6731 and 0.5785.

Correlation coefficient (r)

As mentioned above, one of the research objectives was to investigate the correlation between behavioral characteristics in HMTM and CARS tests in order to assess the HMTM method as a diagnostic test and a therapeutic method. To this end, the features of these two tests that would seem to be clinically relevant were studied and determined by Noor Autism Center experts.

The results obtained include the followings: With larger sample size, one can expect to obtain higher correlation coefficient, and the samples size clearly related to the value of correlation coefficient. Also, usually with higher correlation coefficient, a smaller p-value is obtained, which means the increased chance of an actual relationship

between the two variables, here the features of the two tests. Also, there is a lower probability that the correlation coefficient obtained would be due to chance. For example, one can say that if p-value is equal to 0.05, the analysis suggests by 95% probability that the correlation coefficient obtained represents the relationship between the two variables, and there is only a 5% chance that the value is obtained by chance and coincidence. Thus, the smaller the p-value, the more reliable is the correlation coefficient.

It is also clear that most of the features that seem to be clinically relevant are really connected. Since, as dealing with human and study of human behaviors, even correlation coefficients greater than 0.5 are considerable. But in some cases, the features were not associated much that can be due to reasons such as errors in experimental and clinical techniques, low volume samples and the unavailability of complete scores for all month for everyone.

It should be noted that since the purpose of CARS test was reducing the score, while the aim of HMTM test in these features was increasing the behaviors, obtained negative values for the correlation would be reasonable.

Among the features surveyed, the following characteristics in CARS HMTM tests showed the highest correlation, i.e., greater than 0.7. It should be in these cases, the size of samples was more suitable.

1. Characteristic of verbal communication in CARS test with features of phonation, speech imitation and comprehension of one-step sentences in HMTM test.

2. Visual response feature in CARS test with appropriate eye contact feature in HMTM test.
3. Characteristic of using objects in CARS test and sensorimotor games in HMTM test.

If we consider the correlation coefficients greater than 0.5 adequate and reliable, the following results can be found regarding the relationship between the characteristics of these two tests:

Every feature of CARS is associated with several features of HMTM. This means given the complexity and magnitude of autism spectrum disorders, the patients should be evaluated more precisely with more details for diagnosis and assessment of treatment process. For example, the characteristic of communication with the people examined in CARS test contains subsets that are important and raise various aspects of this type of communication. It can be concluded that HMTM test, which examines each of the patient's communication and behaviors separately in details, is more suitable for diagnosis and assessment of disease treatment process.

Some of CARS features having many relationships that with some features of HMTM according to the correlation coefficients obtained are specified in (Table 2). In fact, these tables show the connections that have been proven quantitatively.

In Table 3, another study of correlation coefficients between HMTM features, which were typically calculated in a chart and the features had high significant correlation coefficients are given.

Conclusion

The data were related to children who were treated for one year by HMTM method that their CARS and HMTM tests were separately evaluated and then compared with each other.

We can say the children have progressed in many of the characteristics, and their conditions have changed from sever abnormal condition to moderate and even mild abnormal conditions. These findings indicate the effectiveness of the treatment method as behavioral therapy and based on special behavioral check lists. Another considerable point is the high relationship and correlation between CARS and HMTM features, which due to the complexity of autism spectrum disorders, may reflect the insufficiency of CARS features to examine and diagnose the children with autism. Each feature has subsets, and in addition to a holistic view of the children, their behavioral communicational characteristics should be examined in more details and more accurately. This can be effective in diagnosing the disease and assessment the treatment process. In this regard, HMTM can be more helpful than CARS for more accurate interpretation. In other words, the holistic approach in HMTM method could well interpret some ambiguous indicators in CARS method. In addition, the implementation of this model resulted in rapid and dramatic progress of children in improvement of individual transactions and sensory balances. Given the breadth and complexity of autism spectrum disorders, by increasing the sample size and receiving a more complete data set, other various aspects of the disease such as the impact of age, gender, environment and family and community connections on the current findings as well as analyzing the relationship or difference of brain signals of patients

together and with healthy children can be studied.

Conflict of interest: None.

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Table 2: Correlated characteristics of HMTM and CARS based on quantitative data

CARS	HMTM		r	P-value
Communication with the people	Emotional and social interaction	Good eye contact	-0.778	0.000
		laugh	-0.561	0.000
		Emotional states face	-0.541	0.000
		Frustration tolerance	-0.517	0.000
	Social skills, communication	Appropriate social response	-0.513	0.000
Imitation	Language	Voice	-0.645	0.000
		Imitation behavior	-0.534	0.000
	Speech perception	Reticence	-0.521	0.000
		Understanding sentences, one-stage	-0.689	0.000
		Understanding sentences, two-stages	-0.570	0.000
		Observing the shift	-0.594	0.001
Emotional response	Emotional and social interaction	Emotional states face	-0.561	0.0000
		Frustration tolerance	-0.578	0.000
The use of objects	Games	Games sensorimotor	-0.767	0.000
		Game Performance	-0.613	0.000
Adapt to change	Emotional and social interaction	Frustration tolerance	-0.660	0.000
Verbal communication	Language	Voice	-0.754	0.000
		Imitation speech	-0.728	0.000
		Proper use of the pronoun	-0.564	0.000
		The ability to define the pictures	-0.575	0.000
		Recitation with no picture	-0.500	0.003
	Speech perception	Speech clarity	-0.609	0.000
		Tribute speech chain and joined together	-0.534	0.000
		Reticence	-0.556	0.000
		Understanding sentences, one-stage	-0.724	0.000
		Understanding sentences, two-stages	-0.632	0.000
The level and stability of rational responses	Speech perception	Understanding sentences, one-stage	-0.694	0.000
	Social skills, communication	Appropriate social response	-0.667	0.000
Non-verbal communication	Language	Voice	-0.581	0.000
	Speech perception	Understanding sentences, one-stage	-0.634	0.000

Table 3: Display of correlation coefficient between HMTM items with comparing the means

HMTM	Cases	r	P-value	HMTM
Voice	53	0.645	0.000	Imitation behavior
Voice	29	0.540	0.002	Proper use of the pronoun
Proper use of the pronoun	26	0.571	0.002	The ability to define the pictures
Speech clarity	29	0.767	0.000	Tribute speech chain and joined together
Speech Clarity	40	0.722	0.000	Understanding sentences, one-stage
Speech clarity	38	0.602	0.000	Understanding sentences, two-stages
Speech clarity	33	0.614	0.000	Observing the shift
Tribute speech chain and joined together	30	0.577	0.000	Understanding sentences, one-stage
Tribute speech chain and joined together	29	0.557	0.001	Understanding sentences, two-stages
Tribute speech chain and joined together	28	0.670	0.000	Observing the shift
Understanding sentences, one-stage	39	0.810	0.000	Understanding sentences, two-stages
Understanding sentences, one-stage	33	0.651	0.000	Observing the shift
Understanding sentences, two-stages	32	0.712	0.000	Observing the shift