
THE OUTCOME OF A SAMPLE OF PRE-SCHOOLERS DIAGNOSED WITH ASD COMORBID WITH ADHD AFTER ONE YEAR OF APPLIED BEHAVIOURAL ANALYSIS

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Abstract

Autism Spectrum Disorders (ASD) are highly heterogeneous disorders. The heterogeneity of Autistic Spectrum Disorders can be determined by comorbid psychiatric disorders like ADHD (Attention-Deficit/Hyperactivity Disorder).

The objective of this research is to analyse the outcome of a sample of pre-schoolers diagnosed with Autism Spectrum Disorder (ASD) comorbid with ADHD symptoms involved in an Applied Behavioural Analysis program and to compare the efficacy of ABA between this group and a control group comprised of children with ASD alone.

We monitored, using ADOS (Autism Diagnostic Observation Schedule) and ADHD -RS (ADHD Rating Scale) at the baseline (T0) and after one year (T1), a sample of 48 children (2-5 years old) diagnosed with ASD and with

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ADHD symptoms. In this period the children follow an applied behavioural analysis program (2 hours / day, 5 days / week for 1 year).

After one year of applied behavioural analysis, the improvement in ADOS scores in the control group was significantly higher than for those in the study group ($F=9.08$, $p=.00$, partial Eta squared = .82).

Keywords: ASD, ADHD, Applied behavioural analysis

Introduction

Autism Spectrum Disorders (ASD) are a group of highly heterogeneous disorders expressed by a wide range of symptoms of varying degrees of severity that determine different degrees of disability. The heterogeneity of Autistic Spectrum Disorders can be determined by comorbid psychiatric disorders, which can alter not only the clinical aspects, but also the therapeutic approach, evolution, and prognosis. The existence of a comorbid condition is associated with the increase in the severity of the psychosocial aspects of the main disorder and with poor response to treatment (Fuentes et al 2014, Dobrescu, Rad & Nedelcu, 2016.)

Attention Deficit/Hyperactivity Disorder (ADHD) is one of the most common comorbid disorders of Autism Spectrum Disorder. Although diagnostic manuals have long considered the presence of Pervasive Developmental Disorders as an exclusion criterion, The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (APA, 2013), regulates this aspect, and thus, recognizing this comorbidity theoretically determines an improvement in the clinical and therapeutical management of comorbid disorders (Fuentes et al, 2014, Dobrescu et al, 2016, APA, 2013).

There are several studies in the literature that had validated the ASD-ADHD comorbidity even before the DSM-5. Davis and Kollins, in 2012, reported that 30-50% of ASD children also meet ADHD criteria, and 2/3 of children diagnosed with ADHD also have features of the autistic spectrum (Davis & Kollins, 2012). The studies quoted by Andersen in 2013 report comorbidity between 14% and 78%. Genetic, neuroimaging, neurocognitive and psychopathological studies have suggested the possibility of an etiopathogenic link between ASD and ADHD (Andersen, Hovik, Skogli, Egeland, Øie, 2013).

In 2013, Mattard-Labrecque and colleagues quoted studies by Goldstein and Schwebach, which report that 59-83% of children with ASD may have symptoms that allow the diagnosis of ADHD, as well as Gillberg's studies that reported in 2004 that 65-80% of children with ADHD also have autistic spectrum symptoms (Mattard-Labrecque, Ben Amor & Couture, 2013).

The presence of ADHD symptoms in a child with ASD thoroughly affects the educational approach, social functioning and community integration of the child. Over time, the specific ADHD symptoms may even become the main symptomatology (Pearson, 2013).

Leitner, in 2014, states that, for children with ASD, the presence of ADHD specific symptoms could raise the severity of social difficulties and this comorbidity could be related to a low response to the psychotherapy process. Each of the two disorders benefits from a specific behavioural intervention and, in cases where they are associated, the therapeutic programme should combine the specific techniques. (Leitner, 2014).

Objective

The objective of this research was to compare the treatment response of ABA for preschool children with ASD alone as compared to ASD comorbid with ADHD.

The hypothesis of the study was that the improvement of ADOS scores after one year of ABA therapy will be lower for the experimental group with ASD and ADHD than for the control group.

Methods

Participants

All the subjects were selected from the patients of the Child and Adolescent Psychiatry Department, of the "Prof. Dr. Alexandru Obregia" Clinical Psychiatry Hospital between 2014-2016. The study was approved by Ethical Committee of the hospital. Both parents were informed and signed the informed consent to participate at this research.

The inclusion criteria were for study group:

- age between 2 and 5 years,
- a diagnosis of Autism Spectrum Disorder (Autistic Disorder /Atypical Autism) according to the DSM IV-TR Diagnostic Criteria,
- the presence of ADHD-specific symptoms, the availability and existence of material and time resources to follow the applied behavioural analysis (2 hours / day, 5 days / week for 1 year).

Patients with significant comorbid disorders – psychiatric (intellectual disability) or somatic (neurological disorders like epilepsy, genetic disorders and severe chronic somatic disorders) were excluded, as were those who received psychopharmacological treatment prior to being included in the study or who began using it at any time during the study.

A total of 48 subjects (39 males and 9 females), with a mean age of $3.56 \pm .80$, were eligible and therefore included in the study.

For the control group, the participants were selected from the patients of the same clinic. There were included 48 patients, with ages between 2 and 5 years, a diagnosis of Autism Spectrum Disorder (Autistic Disorder /Atypical Autism) according to the DSM IV-TR Diagnostic Criteria) and no ADHD-specific

symptoms. The comparison group followed the same 1 year program of applied behavioural analysis with the same frequency of 2 hours/ day, 5 days/ week)

Measures and Procedure

All children were included in an applied behavioural analysis program for one year (2 hours / day, 5 days / week). The therapy was performed by a trained psychologist and the protocol of the intervention was developed and implemented by the same psychologist for all subjects (to homogenise the program in the sample).

Data were longitudinal collected: the main symptomatology domains of ASD and ADHD were assessed both at T0 (inclusion in the study) and at T1 moment (after one year of applied behavioural analysis program).

The ADOS-G ("Autism Diagnostic Observation Schedule – Generic") (Lord, Rutter, DiLavore, Risi, 1999), Module 1 (for children without a developed expressive language), Romanian version (ADOS: David, Anton, Stefan, Mogoase, Matu, 2010) was used for the assessment of autistic symptomatology, with a total score above the cutoff value of 7 corresponding to the Atypical Autism category and above 12 to the Autistic Disorder category. The test was applied by either a clinician or a psychologist with special training in ADOS testing. Module 1 of ADOS, dedicated to children without developed speech, was applied for all of the subjects.

The ADHD-RS IV ("Attention Deficit Hyperactivity Disorder - Rating Scale IV") (DuPaul G., Power T., Anastopoulos A., Reid R., 1998, Dobrean, Pasarelu, Balaszi, Predescu, 2019) was used to assess the ADHD symptoms and their severity. The ADHD-RS scores were interpreted using standardized profiles for boys and girls aged 5 years. The scale was administrated by the clinician and we used home version. Parent rated children behaviour and the questions were adapted to the age of the children included in the study group, but without diverting from the original meaning of the question. The placement above the 93rd percentile (p93) is significant for confirming the positive diagnosis of the disorder and a score under the 85th percentile (p85) is significant for the exclusion of the diagnosis

The results obtained with the tools presented above, were used for describing and quantifying the initial and post-therapy deficits, as a measure of monitoring the evolution of the symptomatology. All the tests were applied by an examiner (physician / psychologist) with special training in their administration.

Data analysis

SPSS/Win. 19.0 was used for data analysis. A repeated-measures design was used for studying the differences in ADOS-G and ADHD-RS scores between the two moments with average score differences being listed. The data was examined for normality of distribution and homogeneity of variances, wherever necessary. Age groups and sex differences were ascertained using ANOVAs and

independent t-tests. Pearson's correlations were used to test for associations between the scores.

Results

Scores dynamics for the experimental group (ASD+ADHD) before and after one year of applied psychotherapy

Analysing the experimental group, consisting of 48 children with ASD and ADHD symptoms, we obtained the average ADOS-G Total score (Communication + Social Interaction) at T0 is 12.29 ± 3.47 and the average of the scores recorded distinctly in each of the two domains is 4.63 ± 1.45 for communication and 7.67 ± 2.25 for social interaction.

Depending on the placement of the scores obtained compared to the cutoff values provided in the instrument interpretation guide, the results of the experimental subjects are grouped in one of the classes of the autistic spectrum (25 with autistic disorder [AUT] and 23 atypical autism [PDD]) The mean ADOS-C + Is total score at T0 in the AUT subgroup is 14.68 ± 3.11 with an average ADOS-C score of 5.44 ± 1.41 and ADOS-Is score of 9.24 ± 1.94 . The mean ADOS-C + Is total score at time T0 in the PDD subgroup is 9.7 ± 1.29 , with an average ADOS-C score of $3.74 \pm .86$ and ADOS-Is score of $5.96 \pm .93$.

For the ADHD specific symptom, the mean ADHD-RS total score at time T0 is 26.17 ± 8.67 with an average ADHD-In T0 (Inattention) score of 14.06 ± 4.99 and an ADHD-HI T0 (Hyperactivity / Impulsivity) score of 11.90 ± 4.71 . The distribution of the total score ($W = .989$, $p > .05$) and of the two domains, separately, (In $W = .971$, $p > .05$; HI $W = .975$, $p > .05$) were normal.

There is no statistically significant correlation between ADOS-G and ADHD-RS domains at the T0 moment (Table 1). Significant correlations were obtained only between the symptom domains of ADOS-G (Communication * Social Interaction, $r = .741$, $p < .01$) and, respectively, between ADHD-RS domains (Inattention * Hyperactivity/Impulsivity, $r(50) = .481$, $p < .01$).

Table 1. Pearson correlations between ADOS-G and ADHD- RS scores at T0.

		Inattention	Hyperactivity/ Impulsivity	ADHD- Total
Communication	R	.118	.078	.100
	Sig.	.425	.598	.501
Social Interaction	R	.174	.117	.146
	Sig.	.236	.429	.324
ADOS Total	R	.162	.109	.136
	Sig.	.270	.463	.356

r= Pearson's correlation coefficient

ADOS-G and ADHD-RS scores dynamics

The repeated-measures model shown statistically important differences for the experimental group among ADOS-G scores obtained at T0 and T1, with a decrease in scores in both total Communication + Social Interaction (M ADOS-C+Is (T0) = 12.29± 3.47; M ADOS-C+Is (T1)= 10.44± 3.74; $t(47)= 5.36$, $p= .00$) and separately on each of the two domains (M ADOS-C(T0)= 4.63± 1.45; M ADOS-C (T1)= 3.52± 1.63; $t(47)= 5.846$, $p= .00$ and M ADOS-Is (T0)= 7.67± 2.25; M ADOS-Is (T1)= 6.92± 2.39; $t(47)= 3.41$, $p= .00$) (Table 2).

Table 2. ADOS-G scores at T0 and T1 moments in the experimental group.

		Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig
Pair 1	ADOS-C+Is(0)	12.29	48	3.470	.501	5.360	47	.000
	ADOS-C+Is(1)	10.44	48	3.741	.540			
Pair 2	ADOS-C(0)	4.63	48	1.453	.210	5.846	47	.000
	ADOS-C(1)	3.52	48	1.637	.236			
Pair 3	ADOS-Is(0)	7.67	48	2.253	.325	3.412	47	.000
	ADOS-Is(1)	6.92	48	2.395	.346			

Significant differences were also observed between ADHD-RS scores obtained at T0 and T1, with a decrease in scores in both total Inattention + Hyperactivity/Impulsivity (M ADHD-T (T0)= 26.17± 8.67; M ADHD-T (T1)= 24.04± 7.05; $t(47)= 2.96$, $p= .005$), and separately on each of the two domains (M ADHD-In (T0)= 14.06± 4.99; M ADHD-In (T1)= 13.15± 4.27; $t(47)= 2.120$, $p= .039$ and M ADHD-HI (T0)= 11.90± 4.71; M ADHD-HI (T1)= 10.58± 3.90; $t(47)= 3.83$, $p= .00$) (Table 3).

Table 3. ADHD-RS scores at T0 and T1 moments in the experimental group.

		Mean	N	Std. Deviation	Std. Error Mean	t	df	Sig
Pair 1	ADHD-T (T0)	26.17	48	8.672	1.252	2.962	47	.005
	ADHD-T (T1)	24.04	48	7.059	1.019			
Pair 2	ADHD-In (T0)	14.06	48	4.987	.720	2.120	47	.039
	ADHD-In (T1)	13.15	48	4.268	.616			
Pair 3	ADHD-HI (T0)	11.90	48	4.714	.680	3.835	47	.000
	ADHD-HI (T1)	10.58	48	3.908	.564			

Score dynamics between the experimental group (ASD+ADHD) and control group (ASD) after one year of applied psychotherapy

There was no significant difference in the ADOS-G Total scores at baseline (T0) between the experimental Autism and ADHD group and the comparison group with Autism only ($U = 1031.50, p = .37$).

Regarding the control group, the decrease of ADOS-G total score between T0 and T1 was significantly higher than in the experimental group ($F = 9.08, p = .00$). (Figure 1)

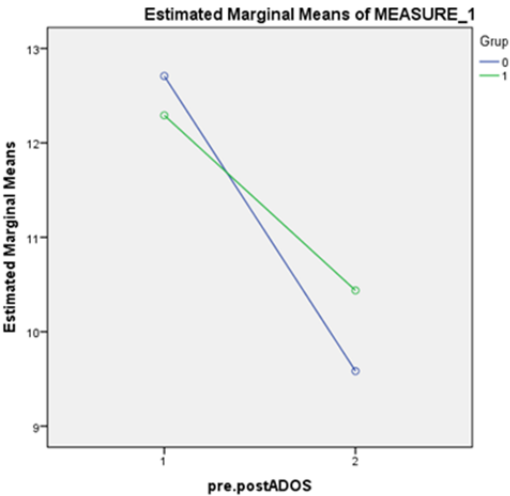


Figure 1. Split plot ANOVA for ADOS scores progress in experimental and control groups.

Table 4 shows the ADOS total Communication + Social Interaction score for the ASD and ADHD group was 12.29 ± 3.47 at T0 and 10.44 ± 3.741 at T1, while for the control group the score went from 12.71 ± 3.094 at T0 to 9.58 ± 3.420 at T1, with a box sig test= .09, $F=9.08$ and $p=.00$, effect size Partial Eta squared = .82.

Table 4. ADOS-G scores and ADOS Social scores and T0 and T1 moments in experimental and control groups.

Moment	Score	Group	Mean	Std. Dev
T0	ADOS Total	ASD+ADHD	12.29	3.47
		ASD	12.71	3.094
	ADOS Soc	ASD+ADHD	7.67	2.253
		ASD	8.13	2.228
T1	ADOS Total	ASD+ADHD	10.44	3.741
		ASD	9.58	3.42
	ADOS Soc	ASD+ADHD	6.92	2.395
		ASD	6.27	2.029

For the ADOS score of Social Interaction, the decrease was also more significant in the control group compared with the experimental group (Box sig .52, $F = 13.82$, $p = .00$, Partial Eta squared = .87). ASD+ADHD group: ADOS-Is (T0) = 7.67 ± 2.253 and ADOS-Is (T1) = 6.92 ± 2.395 , while for the control ADS group: ADOS-Is (T0) = 8.13 and Ados-Is (T1) = 6.27 ± 2.029 .

Discussion

In our clinical sample the applied behavioural analysis therapy significantly improved the ASD symptomatology among children with ASD-ADHD. After therapy, the evolution was positive for a substantial number of children. The differences between ADOS scores (the total ADOS-C+Is domain and separately in each of the two domains) from T0 and T1 points was statistically significant and demonstrate the favourable evolution with considerably improved the ASD-specific symptomatology after one year of therapy. The average total score difference between T0 and T1 is 2.44 ± 2.72 .

The progress of ADOS scores was significant for the ASD-ADHD group ($p = .00$), but it was significantly less substantial than for the control ASD group in both Communication + Social Interaction total score ($F = 9.08$, $p = .00$) and Social Interaction score ($F = 13.82$, $p = .00$).

The conclusion of our research is consistent with studies in the literature. Thus, Leroy et al or Chiappedi et al, studying the developmental trajectory of ASD, consider that some of the children initially diagnosed with Autistic disorder may evolve over time with prompt and early intervention to PDD-NOS (Atypical autism) (Leroy et al, 2010, Nordahl et al, 2013).

In 2014, Weitluf et al. published a report on the effectiveness of applied behavioural therapy in ASD. They conclude that different studies provide clear evidence of improved cognitive and language development after following an intensive behavioural therapy program, but the results published in those studies are not as consistent in regard to social interaction and adaptation. Different responses between individuals after therapy depend on the particularities of each child, as well as on the structure of the therapy program (type, frequency, duration), although it is still unclear how these factors modulate the evolution (Weitluf et al. 2014, Turner, Stone, Pozdol, Coonrod, 2006).

In our sample, behavioural therapy improved ADHD-specific symptomatology too, but the differences were smaller in comparison with those for ASD symptomatology.

The most common evolutionary pattern after one year of behavioural therapy is: a favourable evolution of ADOS-G score and a stagnation of ADHD-RS scores. There is no common approach to ASD comorbid with ADHD, although behavioural therapy is the basis of the intervention for both disorders. Intensive applied behavioural therapy specific to ASD, started at an early age, has been

shown to improve social communication and language, but is not effective in ADHD management (Weitluf et al. 2014).

Clinicians and psychologist implied in the mental care of children with ASD and ADHD comorbidity should consider an intervention that combines the specific behavioural techniques for the two disorders (Leitner, 2014).

The patients included in this study received ASD-specific behavioural therapy. Also, their parents were trained in child-specific ASD-stimulation techniques. For this reason, we believe that favourable evolution was evident on the ADOS scale and less obvious on the ADHD-RS scale.

These observations draw attention to the need of developing therapeutic programs that target both ASD and ADHD-specific symptoms. Most researchers agree that more studies are needed to identify the predictors of ASD evolution, as it is still unclear why some children experience different symptoms that change in time.

The limitations of the study include the small number of subjects and a relatively short period of follow-up (one-year of ABA). Furthermore, the principles of ABA therapy state that the intervention should be adapted according to each individual's needs, which makes it hard to have a strictly standardized programme. Further research should be done by extending the study group and considering other factors that could influence the patients' evolution.

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