Attachment as Environmental Factor Influencing the Development of Externalizing and Internalizing Behaviors in Children with Attentional Déficit Hyperactivity Disorder

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Abstract: The current study aims at the relevance of parenting environment in the generation of co-morbid disorders in children diagnosed with Attention Déficit/ hyperactivity Disorder (ADHD). Although considerable evidence has demonstrated that ADHD has a biological and genetic basis, our work points towards family environment and attachment during development. We postulate that attachment style and mothers attitude towards the child early in development, have a role to play in the generation of co-morbid behavior.

We demonstrated that school children experiencing insecure attachment patterns have higher proportion of co-morbid behaviors than secure children diagnosed with ADHD and controls. Results are discussed with regard to the role of environmental and family factors in the development of the illness and treatment course. These findings provide empirical evidence for the differential susceptibility to maternal (principal care person) influences in ADHD children, suggesting the importante of early interventions.

Keywords: Attachment, emotion regulation, mother-child interaction, maternal sensitivity, co-morbidity.

1. INTRODUCTION

Attachment is defined as an inborn behavior organizing proximity towards the mother or the caregiver who provides a sensitive and sufficient attention to child's needs. John Bowlby [1, 2] was the first to point that the parent-infant environment helps to shape infant's brain, their physiological regulation and behavioral patterns of response. Due to the substantial and intensive brain maturation that occurs during infancy, interpersonal experiences during this time may be incorporated into neural development and make enduring changes. Thus, the interaction that occurs within the dyad in order to help infants to regulate affect may provide infants with experience in effective regulatory strategies creating long lasting effects behaviorally, physiologically and at the level of gene expression [3-5].

Maternal sensitivity refers to the quality with which mothers respond to their infant cues appropriately in the first two years of life providing a secure base and a prompt satisfaction and regulation of child's needs. Maternal sensitivity has emerged as the only significant predictor of attachment security in early years [6, 7]. According to the work of Leerkes, *et al*. [8] maternal sensitivity to distress is associated with less affect dysregulation for temperamentally reactive infants. Many authors support the view that mother's positive responsiveness to both positive and negative emotions is highly adaptive for young children, particularly in relation to how they regulate their own emotions [6-8].

Although the frequency and intensity of attachment behaviors decline from early to middle childhood, children retain a need for a parental attachment figure to trust in middle childhood and adolescence [2, 9]. By middle childhood, children have formed already general representations of self, others and relationships based on previous attachment experiences with multiple caregivers. One of the markers for attachment security is maternal sensitivity [1, 2, 10]. Some authors [8] have shown that the effect of maternal sensitivity to infant distress at 24 and 38 months was particularly adaptive for infants who were frequently and intensely distressed. This findings support the view that mother's or Caregiver positive responsiveness to both positive and negative emotions is highly adaptive for young children, particularly in relation to how they regulate their own emotions [11]. Infants whose negative emotions are not attended too sensitively may also struggle to understand the meaning and causes of negative emotions further reducing their ability to respond appropriately to others in social settings [11].

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Temperamentally reactive infants are predisposed to the development of poor affect regulation, behavior problems and problematic peer relations [12-14], suggesting that difficult negatively emotional infants may be most affected by rearing influences [15].

Altered attachment has been postulated as a risk factor for Attention Deficit Hyperactivity Disorder and psychopathology [16-18]. Attachment issues deserve to be addressed in children presenting with disruptive behavior disorders, at least in those presenting with symptoms of ADHD that do not give account to full-blown clinical ADHD diagnosis [19].

ADHD is a disorder with high heritability [20] in which a dopaminergic dysfunction and an executive functions deficit have been postulated [21]. It is possible that ADHD children may have shown reactive behaviors and poor emotional regulation from early infancy [22] by experiencing a synchrony failure with their mothers [23]. Klein-Veldermann *et al*. [23] demonstrated that attachment based interventions were most effective in reactive children and their attachment interactions. A moderate number of sessions and a clear behavioral focus were sufficient to improve maternal sensitivity and attachment security in mothers.

ADHD is the highest co morbid neuropsychiatric disorder. The most frequent co morbidity is Oppositional-Defiant Disorder (ODD), an externalizing disorder, about 60% of ADHD cases. Internalizing behaviors such as a variety of anxiety disorders are also common, about 20-33% [24]. The assumption of impaired emotional regulation abilities in ADHD children is in part supported by the high rates of internalizing behaviors in these children, among them separation anxiety, depression and social phobias are the most frequent [25, 26]. We investigated if the quality of attachment and parenting environment would influence the generation of ADHD symptoms and vulnerability to internalizing and externalizing behaviors in school children presenting ADHD.

We postulate that some family conditions and maternal style inducing insecurity in children might contribute to the development of a higher number of co morbid symptoms in children diagnosed with ADHD. Alterations in the treatment course could be also occurring due to family environment.

2. METHODS

47 children between 7 and 12 years old already diagnose with ADHD were recruited for this study. We have assessed attachment security (security / insecurity) by studying the child's perception of security with the main care person (usually the mother). For measuring child's perception of security and quality of parental style we have used the Security Scale (SS) developed by Kerns, Keplan and Cole [27].

This 15 item questionnaire measures the degree to which school children (6 to 12 years old) believe an attachment figure is responsive and available, their tendency to rely on them in times of stress, and their reported easy an interest in communicating with the attachment figure. Security scale has been correlated with peer ratings of friendship quality and mother's report of acceptance of the child [27]. Each item on the SS was score from 1-4 with higher scores indicating a more secure parent-child attachment. Items scores were averaged so that each child received a total score on a continuous dimension of security. 15 questions measure the degree to which children believe an attachment figure is responsive and available. Items were formulated as: Some kids…; instead, other kids… Children were told to indicate which statement was more characteristic of them and then to indicate if that statement was really true for them or sort of true. Children showing signs of drug abuse were left out of this sample.

The sample of 47 children underwent a battery of neurological examinations to determine possible psychiatric co-morbidity described somewhere else [28]. 30 controls children were selected from a public school and were matched by age, education and socioeconomic status. Informed consent was obtained from parents before the study began.

Mothers of the ADHD children were separately interviewed to determine relational family issues, the existence of early separation episodes, and mother's willingness to serve as an attachment figure.

2.1. Statistical Methods

The data analysis was conducted using MINITAB 15 Statistical Software®. We separate ADHD children in two groups: ADHD children with comorbidities (more than one) (ADHD/COM+) and ADHD children without comorbidities (ADHD/COM-).

ANOVA was used to compare continuous variables (age and security score) and χ^2 to compare categorical variables (sex and sub type).

3. RESULTS

We found higher number of insecure children according to the SS in the group presenting more co morbidity. We determined that insecure children, those presenting lower scores in SS, presented much more co morbid behaviors such as ODD, than children presenting one co- morbid behavior and showing higher security scores (secure attachment) COM (-). The group presenting more than one co morbidity COM (+) showed lower scores in SS (being classified as insecure). This group was slightly younger in average than the group without co morbidities. Control children underwent same procedure showing higher scores in SS as observed in (Figure **1**).

Table **1** depicts the demographic characteristics of the three groups in terms of mean scores in the attachment security scale (SS) and each group compared to controls. These values are similar to those obtained by Kerns and collaborators (27) in a similar age sample.

Table 1: Demographic Characteristics of ADHD and Control Groups

	ADHD COM (-)		ADHD COM (+)		CONTROL		
SEX	**N**	**%**	**N**	**%**	**N**	**%**	**p value**
Male	18	72	18	82	23	79	0,8
Female	7	28	4	18	6	21	
Total	25	100	22	100	29	100	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**p value**
Age	9,7	1,4	10,3	1,4	11,4	1,5	<0,00001

Figure 1: Mean security scale scores in three groups of subjects. COM (-) indicates ADHD subjects without comorbidity (white). COM (+) indicates ADHD subjects with comorbidity (black) and controls (grey).

The group of ADHD children presenting the highest co morbidity ADHD /(COM (+) presented significant lower scores in the mean values obtained in the Security Scale respect to the control group and the group with no co morbid disorders ADHD /(COM (-) as shown in Figure **1**.

Comorbidities detected in the group designed ADHD /COM(+) were shown as externalizing as well as internalizing behaviors. Most frequent comorbidity found was opposition defiant disorders (ODD) followed by a variety of disorders, such as anxiety depression, dystimia and behavioral disorders. Interesting is the fact that scores of the ADHD children with only one comorbid behavior (COM-) were similar to controls.Familiy environment and maternal disposition was found appropriate in 80% of the cases, using a scale of 1 to 5.

Figure **2** shows the distribution of comobidities in the population of school children participating in this study.

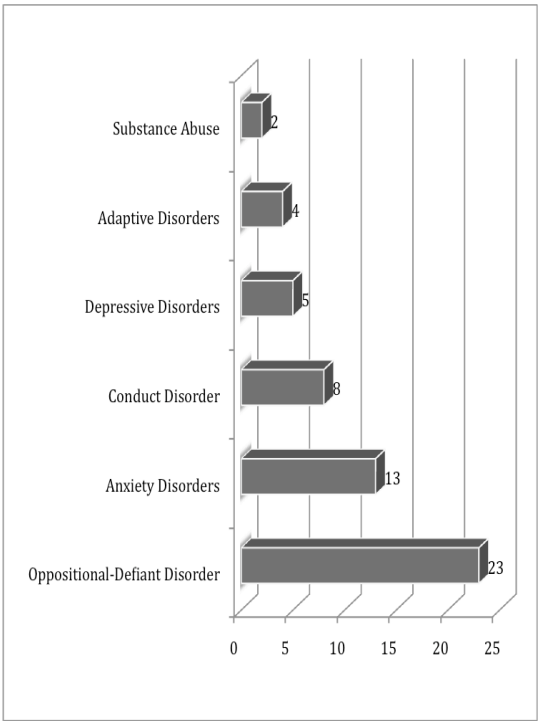

Figure 2: Distribution of co morbidity in a sample of 47 subjects.

Mothers were separated interviewed to determine family situation and relational skills present in the family.

In two cases in which the children were not living with their mothers, these children presented the lower rates in SS.

4. DISCUSSION

Genetic and environmental factors have been mentioned to predispose to ADHD [29, 30, 31]. The presence of allelic combinations predisposing for ADHD (DRD4-4 and DAT1) in the Chilean population have been demonstrated [28] indicating the participation of genetic predisposition for ADHD. Although we have done genetic studies in these subjects (DRD4-4 and DAT1), data will not be presented here.

The present paper demonstrates that the presence of co- morbid behavior inversely correlates to attachment perception of security in children. Although genetic contribution has an important role in the manifestation of ADHD, parents and rearing environment may still play a role in the development of illness, comorbidity [17, 34] and treatment success.

The influence of attachment and early experience has been studied in relation to ADHD and behavioral vulnerabilities in few studies [18] addressing disorganized attachment [5, 19] and desinhibited attachment styles [32]. These studies indicated that attachment security might play a role in ADHD development. To our knowledge no data are available with respect to attachment and ADHD in pre-adolescent subjects. Lower levels in the security scale were significant associated with an increase in co morbid behaviors like ODD, separation anxiety, dystimia, social phobia and higher levels of hyperactivity. On the contrary, higher scores in the SS obtained from ADHD children classified as secure indicated less co morbid behaviors or just one.

The presence of co morbidities in insecure children compared to their absence in so-called secure (but presenting with ADHD symptoms) gives support to the hypothesis of attachment and parental environment influencing illness development and treatment course. Insecure attachment might favor the development of co morbid behaviors such as anxiety, ODD, hyperactivity social phobia and dissocial behavior.

Early Child Care Research Network demonstrated the fact that sensitive mothers were found to have children with few internalizing and externalizing symptoms and high levels of social competence [33]. Mothers who provided positive guidance during play have children who used affective regulation strategies in emotionally challenging situations [12]. This is consistent with our hypothesis that maternal care in early years might have effects on later emotional regulation of externalizing and internalizing symptoms in children suffering from ADHD. Curiously, children with lowest rating of the SS were those not having a reliable attachment figure at home at the time of the interview. This might be due to mothers´ absence or other circumstances including illnesses or death of a parent.

Our findings speak in favor of the hypothesis of parental environment influencing illness development and treatment success. The absence of the mother as principal care person in the Chilean culture, together with a non-adequate environment produced the most externalizing behaviors in children.

Denham *et al.* [34] reported that the beneficial effects of proactive parenting (i.e. supportive presence and clear limit setting) at age 7-9 were more pronounced in the case of children who score high on externalizing problems at an earlier time of measurement.

Klein-Velderman, *et al*. [23] found that experimentally induced changes in maternal sensitivity exerted greater impact on the attachment security of highly negatively reactive infants than it did on other infants. In both cases environmental influences on vulnerable children for better instead of worse demonstrated the proactive influence of sensitive parenting [15]. More specifically, Van Zeilj *et al.* [35] confirmed the hypothesis that children with difficult temperaments are more susceptible to maternal discipline, for better and for worse.

La Freniere and Capuano [36] demonstrated successful interventions with anxious withdrawn preschool children, indicating the role of competent parenting in emotional regulation skills.

On the behavioral level, a vicious circle system could be taking place between the parents and their anxious ADHD children. Some family environments are not supportive for the kids and their treatments. Mothers´ characteristics can also play a role in illness development. Mothers with ADHD were found to be poorer at monitoring child's behavior and less consistent disciplinarians compared to controls [37]. Mothers with depression or other mental disorders are not able to deal with difficult children in general [38, 39]. In the case of mothers presenting symptoms of ADHD, they may show, in some cases, inattentive or less sensible behaviors and low maternal sensitivity towards the child. Seipp and Johnston [40] found that mothers of children presenting ADHD and oppositional defiant disorder (ODD) were less responsive and more hostile than control mothers, although they did not measure attachment of those children. Bakersmann-Kranenburg and van Ijzerdorn [14] have shown that

children carrying the allele DRD4-7 were more prone to develop externalizing problems when mothers showed insensitive behaviors in early years. Genetic studies should contribute to understand the interplay between genetic and environmental contributions in ADHD. Evidence of epigenetic transmission of sensitive mother care enhancing the development of dopaminergic system and stress regulation in the rodent offspring was reported [41]. Rodent models of care can be relevant to our data in regard to mothers´ behavior and attitudes towards their ADHD children.

The association between maternal sensitivity to distress, genetic factors and infant outcome in temperament reactive infants (who might present ADHD symptoms later on) can be a cue for the presence or absence of comorbidity.

Vulnerability to illnesses has shown to be the result of the interactions between environmental conditions and genetic heritage. Although genetic determinants are playing an important part during development, environmental factors can be of pivotal importance in the development of some illnesses, such as ADHD.

5. LIMITATIONS OF THIS STUDY

Although no attachment instrument was applied to the mothers, a qualitative survey to detect their willingness to serve as attachment figure was assessed, indicating the disposition to attend the child needs adequately. Family environment was explore only at programed interviews with the mother; no family visits were made. Other members of the family such as the father, were not interviewed. Considering the cultural environment, chilean population relies on the mother (more than the father) as an attachment figure, which can be a limitation for the study. We did not measured attachment per se, with specific instruments. We have measure perception of security in children at this point (9-12 years old) of development.

CONCLUSIONS

The study demonstrate that the presence of one or more comorbid behaviors are directly correlated to the perception of security in children between 9-12 years old. The more comorbidity, the less perception of security.

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