Relationship disorders and cognitive functioning in young children

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The aim of this study was to investigate the cognitive functioning of young children with or without relationship disorders with their mother. Mother-infant dyads were recruited during the first three postpartum days. Parent Infant Relationship Global Assessment Scale (PIRGAS) scores and mother-child relationship disorders were decided when children were 41-49 months of age by integrating the data obtained from psychiatric interview with mothers, Clinical Problem Solving Procedure (CPSP) and home observation. Cognitive functioning of young children was evaluated with Stanford-Binet Intelligence Scale. The young children without relationship problems/disorders had higher intelligence quotient (IQ) scores even after controlling for the effect of independent variables on cognitive functioning. These findings suggest that there is a link between the quality of the mother-child relationship and cognitive functioning in young children. Therefore, physicians should assess the interactions of children with their mothers even if they are brought for reasons other than relationship problems.

Key words: child development, cognition, mother-child relationship.

Cognitive development, as well as other developmental processes in children, is determined by interactions of facilitating and impeding biological and environmental factors, according to the transactional theory of development[1]. Familial, social and environmental factors are as important as the child's genetic and other biologic constitution in the assessment of cognitive development.

The role of the quality of the mother-child relationship in cognitive and social-emotional development of young children has been investigated in many studies. The capacity of mothers to engage positively with their child in social interactions is an important component of this relationship. Factors related to the mother such as sufficient cognitive stimulation, positive affective involvement, sensitivity, responsiveness, encouragement of initiative, and elaborateness were found to be important factors in supporting the cognitive development and communication of young children[2-6]. Maternal cognitive stimulation has been reported to be associated particularly with the development of social relationships, cognition and language[5,7,8]. Positive, warm, sensitive, and responsive parenting behavior were found to have effects on both cognitive and social-emotional development of young children, even in high- risk groups such as preterm children and multiple pregnancies[3,4,9,10]. Consistent with these findings, a lack of sufficient cognitive stimulation, positive affect and maternal sensitivity, especially in chronic and recurrent maternal depression, may significantly affect the child's learning capacity[11-13]. It has also been indicated that cognitive development in the children of mothers with postnatal depression might be improved by treating maternal depression with intensive and prolonged interventions, along with better mother-infant relationships[14].

Cognitive development of children was found to be related to their own characteristics

such as affect regulation, responsiveness and temperament in this relationship[6,15,16]. Early interactive rhythms and parent-child synchrony were also determined to be related to the child's cognitive performance and social-emotional competence[10,17,18]. Associated with all these features of mother and child in a reciprocal relationship, early secure attachment experiences might be related to the cognitive and emotional development of young children[19-21].

Although the impact of these factors related to mother and child on cognitive development of children was assessed in various studies, to our knowledge, there has been no study investigating the mother-child relationship disorders as described in Diagnostic Classification: 0-3 (DC: 0-3)[22] in relation to cognitive functioning. Considering the relationship between mother and child as a whole and as bidirectional, we investigated not only the components of this relationship related to the mother or her child, but also evaluated the impairment in the mother-child reciprocal relationship by using a diagnostic tool, DC: 0-3. DC: 0-3 is a semi-structured clinical tool based on developmental evaluation to determine and classify the mental health and developmental disorders of children in the first years of their lives. It is a developmentally sensitive addition and complement to the preexisting classification systems like the Diagnostic and Statistical Manual of Mental Disorders (DSM), and despite its title, it has been widely used in children from birth to age five[23]. DC: 0-3 was used in some studies evaluating the mother-child relationship as well as the development and psychiatric diagnoses of young children in our country[24,25].

In this study, we aimed to assess the connection of mother-child relationship disorders determined by DC: 0-3 and the cognitive development of young children.

Material and Methods

Subjects

Mother-infant dyads were recruited from the obstetrics inpatient unit of the Department of Obstetrics and Gynecology in Hacettepe University Hospital to control prenatal and perinatal variables prospectively. Since the mother-infant dyads without prenatal and perinatal problems are followed up as obstetrics inpatients in the first postpartum days in our hospital, the subjects were enrolled from this unit. The aim and design of the study were explained to the mothers during the first three postpartum days and informed consents were obtained. Sociodemographic information, prenatal and perinatal history, and physical condition of the infants were recorded in the postpartum evaluation. Mother-infant dyads were excluded from the study if one of them had a severe prenatal or perinatal problem. Infants with a birth weight lower than 2500 grams or mothers with a pregnancy period shorter than 35 weeks were also excluded. Forty-nine mother-infant dyads were included in the study, and 26 of them (53.1%) participated in the second evaluation when the children were 41-49 months of age. The subjects did not constitute a clinical population and none of the children were admitted to our clinic due to developmental, emotional or behavioral problems. Three of the mother-child dyads could not be seen due to their relocation to another city. Five mothers did not agree to participate in the second evaluation. One mother could not come due to physical illness. The remaining 14 mother-child dyads could not be reached. There were no differences between the two groups, those evaluated in the first session but who did not come for the second session and those evaluated in the second session, in terms of gender, maternal or paternal age and education, and presence of sibling(s).

The mean age of children was 46.1 ± 2.3 months (range: 41 to 49 months). There were 15 boys (57.7%) and 11 (42.3%) girls. All of the 26 cases lived with nuclear families. Twenty children (76.9%) had sibling(s). There was no history of a long separation from mothers in any case. None of the children had a chronic physical illness or growth retardation. No psychiatric disorder was reported in the mothers.

Method

Clinical Interview

The researchers developed a semi-structured interview form to collect data related to the

development of the child, caregiving experiences of the family, daily routines, amount and content of time spent with the child, complaints by the mother about a child's emotional and behavioral development, information about the mother's involvement and supervision of the child, the child's relationship with family members, and general functioning of the mother-child dyad. The medical and psychiatric histories of parents were also obtained.

Mothers were interviewed with their young children by the same child psychiatrist throughout the study. The following are some of the questions contributing to the evaluation of the mother-child relationship directly or indirectly: How did you imagine that your relationship with your child would be? How is the relationship between the two of you now? How do you feel about it? Is there any problem in this relationship? If there is a problem, under which circumstances does this problem occur/improve? What is your attitude toward this problem? What kind of activities do you share? How do you control/discipline your child? What is your child's attitude towards them? If there is intolerance for frustration, how do you cope with this problem? What kind of tasks does your child achieve by him/herself? What should he/she be able to do in your opinion?, etc. Throughout the interview, clinical observation of the mother-child interaction was performed, including the evaluation of mutual engagement and willingness, shared affective tones, the mother's sensitivity and attunement to the child's hints, the mother's ability to regulate the child's emotions, the child's ability to behave autonomously, and his/her capacity for relatedness with the clinician.

The Clinical Problem Solving Procedure (CPSP)[26-28]

The CPSP is a semi-structured procedure designed to assess the parent-child attachment relationship as reflected in the interactions between mothers and their young children who are 12-54 months of age. It involves free play, clean-up, four teaching tasks, and a separation and reunion episode. All mother-child dyads were observed in a 4 x 3 meter playroom with a one-way mirror. The same toys and chairs were in the room for each observation. Instructions for the CPSP were given to the mothers prior to the sessions. They were instructed to help in case they felt their children needed it. First, the mother and the child entered the playroom and played freely for 10 minutes as they would at home. The mothers had the children clean up all of the toys in 5 minutes after the free play episode. Before the specific tasks, the mother blew bubbles and had the child pop them for 3 minutes. Then four tasks, two of which were below and two of which were above the child's developmental level, were given to the children. The last two tasks were difficult enough to require the mother's assistance for the child to complete the tasks. The mother left the room as she would at home and stayed outside for no more than 3 minutes. Then, the mother re-entered the playroom and called the child's name.

Supportive presence and quality of assistance of mothers in the third and fourth tasks were evaluated. Evaluation of supportive presence included the mother's attention and interest by the child in the task, allowing for the child's exploration of the tasks, understanding the child's behavior correctly, encouraging the child's sense of achievement, sharing pleasure at task completion, and valuing the child's experience in his/her performance. Quality of assistance of mothers included skills of helping the child understand the goal of the task, giving the child the opportunity to discover independently, and giving necessary assistance and hints in a flexible way. At the same time, the children's approach to tasks and their relationship with the mother for the entire session were evaluated. Approach to tasks includes being enthusiastic about tasks, persistence and self-reliance. The relationship with the mother includes affection, negativity, avoidance, and controlling behavior. The anxiety level of children and compliance to their mother's suggestions were also evaluated. The evaluators discussed and determined what they would have to observe in CPSP before the second evaluation process of the study. Findings of the observation were recorded by two child psychiatrists separately at the same time in detail.

Home Observations

The evaluation process of the mother-child relationship included an observation in the

family's home setting. Home observation was based on assessing the relationship between mother and child in their natural environment. Young children and their mothers were observed in a free play session for 30 minutes in their home in order to investigate the interactions between them by a social worker who was blind to the CPSP evaluation results. The social worker is an experienced professional in child observation and given structured instructions relevant to CPSP for these observations. The children's and mothers' behaviors and their interactions, affective tone and reciprocal sharing, the resistance of children to their mothers' interactions, the psychological involvement and availability of the mother, the mothers' responses to their children, and children's responses to the observer were assessed and recorded in detail in running notes.

Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Diagnostic Classification: 0-3 (DC: 0-3)[22]

DC: 0-3 contains multiple axes in order to evaluate the problem of a child in different aspects and to achieve a formulation. Axes I to V determine primary psychiatric diagnosis; parent-child relationship disorders; physical, neurological and developmental problems; psychosocial stressors; and the functional emotional developmental level of the child, respectively. In this study, we only used the Axis II relationship disorders classification. The DC: 0-3 Axis II includes Parent Infant Relationship Global Assessment Scale (PIRGAS)[29], which evaluates the quality of the caregiver-infant relationship functioning on a continuously distributed scale, ranging from 90 (well adapted) to 10 (grossly impaired). Scores equal to or lower than 40 indicate the presence of a relationship disorder. Scores of 41-80 indicate the signs and symptoms of relationship disorder that are not severe enough to be considered a disorder. Scores higher than 80 indicate an adapted relationship.

Stanford-Binet Intelligence Scale

The third version of the Stanford-Binet Intelligence Scale[30] was used in this study. It covered the age range of 2½ to 18. Although this version has attempted to balance verbal and nonverbal content, it is primarily a verbal test. Measured ability is a single factor, named general intelligence. Items in the test relate to knowledge, fluid reasoning, visual-spatial processing, quantitative reasoning, or short-term/working memory. It is an age scale making use of age standards of performance. Items were grouped according to the age levels. There were six items in each age level, and also an item as an alternate. Consequently, mental ages and intelligence quotients (IQs) were stated. The bi-serial correlation for the scale is 0.66. At the preschool level, 2½ through 5, it is 0.61; for 6 through 14, it is 0.61. The adult levels have the highest correlation, with a mean of 0.73. Reliability is increased by reason of its high level of bi-serial correlations between individual subtests and the total. Although there was no adaptation and standardization study of the test for the Turkish sample, the third version's translated form was used in this study. Standard materials were used and a highly trained clinical psychologist administered the test. All of the clinicians who evaluated the mother-child relationship were blind to the results of the Stanford-Binet Intelligence Scale.

Procedure

The study was completed in three sessions. The first session was held in the inpatient unit of the Department of Obstetrics and Gynecology by one of the child psychiatrists with mothers, who were within three days postpartum and agreed to participate in this study by giving sociodemographic, prenatal and perinatal information. The clinical psychiatric interview, CPSP and Stanford-Binet were applied in the second session when children were 41-49 months of age. The clinical interview was performed by a child psychiatrist and CPSP was carried out and recorded by two child psychiatrists, separately. In the third session, mother-child dyads were observed in their homes within two weeks of the second session. After the completion of all three sessions, researchers who obtained clinical information and observed the dyads in the play room and at home met, discussed their all observations and determined the quality of the relationship between mother and child by using PIRGAS and DC: 0-3 Axis II. The mothers were provided

with the information about their relationship and cognitive functioning of their children and were advised to remain in follow-up if there was a relationship problem.

Results

The data was analyzed by comparing the two groups of children having relationship problems (PIRGAS scores ≤80) and not having relationship problems (PIRGAS scores >80). Relationship problems were diagnosed in 10 (38.5%) of the children by using DC: 0-3 Axis II. Five (19.2%) of these children had relationship disorders with PIRGAS scores ≤40: 2 under-involved type, 2 angry/aggressive type and 1 anxious/tense type.

One-way ANOVA and chi-square tests were used to determine the differences in continuous and discrete variables between the two groups of children, respectively. Sociodemographic characteristics are given in Table I. Mean age and gender of children and mean ages of mothers and fathers were not significantly different between the groups. Education levels of mothers and fathers were found to be significantly higher in the children without relationship problems. It was determined that mean Stanford-Binet scores were significantly lower in the group of children with relationship problems, as shown in Table II.

A correlation analysis was conducted to determine the relation between Stanford-Binet scores and independent variables such as children's ages, mother's/father's ages and education levels and mean time period for breast-feeding in both groups. The mother's age ($r=.44$, $p<.05$), father's age ($r=.42$, $p<.05$) and mother's education level ($r=.61$, $p<.01$) were found to be correlated with Stanford-Binet scores. Stanford-Binet scores were not significantly different by gender. Since the ages of mothers and fathers and the education levels of mothers were significantly correlated with Stanford-Binet scores in children with or without relationship problems, the statistical analysis was repeated with one-way univariate analysis of covariance by controlling for the effect of these variables on Stanford-Binet scores. In this analysis, the mother-child relationship was again found to be significantly related to Stanford-Binet scores ($F(1, 21) = 4.920$, $p<0.05$).

When children were categorized into groups with (PIRGAS ≤40) or without (PIRGAS >40) relationship disorder, mean Stanford-Binet scores were again significantly lower in the group with relationship disorders (Mann-Whitney U test, Table II). When PIRGAS scores were not categorized into groups and assumed as a continuous variable, they correlated with Stanford- Binet scores as well ($r=.607$, $p<0.01$).

Table I. Sociodemographic Characteristics

Variable	Children with relationship problems n=10	Children without relationship problems n= 16	Statistics
	Mean (SD)	Mean (SD)	
Age (months)	46.3 (2.6)	46.0 (2.2)	F=0.099, p=0.756
Gender	n (%)	n (%)	
Boy	8 (80)	7 (43.7)	X^2=3.313, p=0.069
Girl	2 (20)	9 (56.3)	
	Mean (SD)	Mean (SD)	
Age of mothers (yrs)	31.3 (4.6)	34.4 (6.2)	F=1.791, p=0.193
Education level of mothers (yrs)	9.6 (3.1)	12.5 (3.5)	F=4.663, p=0.041*
Age of fathers (yrs)	35.7 (4.4)	38.9 (6.7)	F=1.752, p=0.198
Education level of fathers (yrs)	11.0 (3.1)	13.7 (1.9)	F=8.035, p=0.009**

*p<0.05, **p<0.01

Table II. Stanford-Binet Intelligence Scale Scores (Mean ± SD)

Children with relationship problems n=10	Children without relationship problems n=16	Statistics
109.6 ± 8.2	127.7 ± 14.9	F=12.239, p=0.002**
Children with relationship disorders n=5	Children without relationship disorders n=21	
107.0 ± 6.5	124.0 ± 15.2	U=13.00, p=0.01**
All children n=26		Minimum-Maximum
120.7 ± 15.4		99.00-164.00

**p≤.01

Discussion

The major finding of this study, the significant association between the mother-child relationship and cognitive functioning in young children who have normal intelligence, points to the importance of the mother's relationship with the child, which can be either a risk or a promoting factor for cognitive development. Other factors correlated with the cognitive development of children are the education level of the mother and ages of the parents: the higher the maternal education the higher the IQ, and the lower the parental age the lower the IQ. These results are compatible with other studies in the literature. Children's cognitive development in a middle income context was found to be negatively associated with unfavorable socioeconomic conditions, poorly educated mother, absent father, poor sanitary conditions, and low birth weight and positively associated with high levels of domestic stimulation and nursery school attendance at five years of age[31]. In another study, Kağıtçıbaşı and her colleagues[32] assessed the effect of a two-year educational intervention of low-income mothers of young children about parenting, coping and communication skills to promote language, discrimination and problem-solving skills of children. They found higher intelligence, academic skills and self-concept and lower aggression in the intervention group.

Biological factors including intrauterine growth restriction, under nutrition, infectious diseases, environmental exposures, and psychosocial factors such as cognitive stimulation, caregiver sensitivity and responsiveness, caregiver affect, maternal depression, and exposure to violence were determined as important factors for child development in developing countries[33]. Therefore, it is crucial to investigate the risk or protective factors, especially the modifiable ones, in these countries. In a study evaluating mothers' knowledge of young child development, it was documented that most mothers were not aware of the expected time of development of gaze, vocalization and social smiling in Turkey[34]. Thus, it may be possible to improve the socio-emotional and cognitive development of children with interventions to the mother-child relationship directly by parent-child psychotherapy or indirectly through decreasing the risk factors for a disordered relationship such as low educational level of mothers. The parent-child psychotherapy aimed at supporting interactions has been reported to foster attachment patterns and cognitive development in young children[35,36]. It was also documented that center care mitigates the adverse effects of insecure attachment on cognitive and language development of low-income children by providing them with a more stimulating environment[20]. These kinds of interventions to prevent adverse outcomes of a disordered mother-child relationship may be encouraged in developing countries if more knowledge about the risk and protective factors in these countries is obtained. On the other hand, cognitive functioning of the children might have an effect on the quality of the relationship between mother and child. Therefore, whatever the level of the cognitive development of a child, a secure mother-child relationship should be promoted due to its protective effect on all developmental fields and the mental health of children.

This study has some strengths and limitations. Observing the interactions between mother and child both in the playroom and in a natural setting provided a broader and more objective evaluation of the mother-child relationship. However, evaluation of the mother-child

interactions in the clinic or at home by different clinicians is a limitation of this study. In addition, home interactions might be influenced by the presence of an observer. The home observer met with mothers and children at the end of the second session and informed them about the nature and purpose of the observation in detail to lessen this influence. The prospective design helped to rule out some risk factors such as intrauterine growth retardation and other prenatal and perinatal problems, but decreased the sample size. A small sample size is an important limitation of this study and restricts the examination of the relation between subcategories of relationship disorders and cognitive functioning as well as generalization of the results. Lack of evaluation for any possible effect of other DC: 0-3 axis diagnoses on the mother-child relationship and cognitive functioning of children is another limitation of this study. Since the cognitive development is a dynamic process that is formed by interactions of enormous biological and psychosocial factors, it may not be possible to control all risk factors or to have an exact decision about the results with a cross-sectional evaluation of cognition. Longer term cognitive, language and socio-emotional development should be examined with larger samples. In this study, the relationship between the child and the father or any other significant caregiver, who might also have provided the child with learning opportunities, was not examined.

In conclusion, there is a link between the quality of the mother-child relationship and the cognitive functioning in young children. Supporting and fostering the quality of mother-child interactions and promoting children's development with preschool education may improve the socio-emotional and cognitive development in children, especially in developing countries where there may be additional risk factors in child development. Cognitive development of children with a disordered mother-child relationship could be supported by intervention programs enabling mothers to provide high quality stimulation and by providing children with more stimulating environments. Therefore, it is crucial to assess the interactions of children with their mothers, even if they are brought to a physician or any other healthcare provider for reasons other than relationship problems.

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