

The Mother-Infant Bonding Scale: Factor Structure and Psychosocial Correlates of Parental Bonding Disorders in Japan

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Abstract Bonding disorders towards their child has been recognized as a serious problem, which might lead to give adverse effects on the relationship with child or maltreatment towards their child. The aim of this study was to identify the factor structure of the Mother-Infant Bonding Scale (MIBS) as well as the determinants of parental bonding disorders in Japan. In this cross-sectional observational study, the MIBS and other psychosocial questionnaires were distributed to 396 fathers and 733 mothers of children aged between 0 and 10, at 20 clinics of Kumamoto prefecture, in Japan. An exploratory factor analysis of the MIBS revealed a two-factor structure: lack of affection (LA) and anger and rejection (AR). A confirmatory factor analysis demonstrated its cross-validity, with no statistical differences between fathers and mothers. A multi-group analysis using structural equation modelling demonstrated that LA and AR were predicted by parental dysphoric mood while only AR was predicted by parental

anger. To be concluded, the current study suggests that the MIBS has two subscales that can be predicted by intra-personal and interpersonal variables, and may provide information applicable to the design of therapeutic or preventive approaches to parents with bonding disorders.

Keywords Child · Parental bonding disorder · Mother-Infant Bonding Scale · Attachment · Gender difference

Introduction

While a baby starts to have a close relationship with the caregiver, usually the mother, immediately after birth, this tie, often referred as attachment (Bowby 1969), is necessarily reciprocal. Despite an abundance of research on the child's attachment towards the caregiver, little has been paid attention to in clinical studies regarding the *caregiver's* tie to the child. The phenomenon of mothers' ejective or even hostile attitudes towards their baby has long been recognised in the history of psychiatry and forensic science but very much neglected among researchers (Brockington 1996, pp. 327–366). This may be due partly to the lack of official classificatory concept and empirical tool to measure it. Kumar (1997) was one of the first researchers to focus empirically on maternal attitudes towards the infant and child. He studied 44 women with a history of at least one episode of psychiatric illness who described a failure to love their infant. These women reported the absence of affection, and also sometimes hate, rejection, and even the impulse to harm their child. He used the phrase “maternal bonding disorder” to describe this phenomenon.

A few instruments have been developed to evaluate maternal bonding disorder. For example, Taylor et al.

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(2005) developed a 8-item self-report. The items of this questionnaire are a list of adjectives describing feelings mothers have towards their baby. Brockington developed the Postpartum Bonding Questionnaire (PBQ). This is a 25-item self-report inventory used to assess maternal bonding with a child (Brockington et al. 2006). It has been reported to have good validity (Brockington et al. 2009) and reliability (Wittkowski et al. 2007). Another instrument is the Mother-Infant Bonding Questionnaire (MIBQ: Kumar et al. and revised by Marks et al., unpublished). After a new item was added to the MIBQ and it was translated into Japanese, it was renamed the Mother-Infant Bonding Scale (MIBS: Yoshida et al. 2012). This is a 10-item Likert-type questionnaire. The MIBS elicits information about parents' feelings of rejection, alienation, and neutrality towards their infants. The MIBS was found to be moderately correlated with the PBQ (Wittkowski et al. 2007; Van Bussel et al. 2010).

Because the MIBS measures different types of parental feelings, we can expect the scale to consist of multiple factors. In a study of 554 postnatal Japanese women 1 month postnatal, Yoshida et al. (2012) found that the Japanese MIBS displayed a two-factor structure. The subscales were lack of affection (LA) (Cronbach's $\alpha = .71$) and anger and rejection (AR) (Cronbach's $\alpha = .57$). However, it is recognised that the same instrument often shows different factor structures when used in a different sample, such as fathers.

Another statistical issue of interest is the possible differences in MIBS factor structure among parents with young children of different ages. Past studies on bonding instruments assessed parents of neonates. Instrument factor structures may differ in parents of toddlers and young children.

Another important issue is the determinants of parental bonding with the child. While the clinical importance of bonding and bonding disorders has increasingly been recognised, the way in which such failures of attachment develop has been little studied. Demographic factors such as the ages of the parents and the child should be considered to be basic variables related to bonding disorders.

Anger towards the child has also been recognised as a negative feeling linked to impaired bonding. For example, as compared with non-abusive parents, abusive parents are more likely to show anger towards their children and to demonstrate a LA (Sedlar and Hausen 2001). Parents who are hostile to people in general may direct hostility towards their child. Thus, anger and the many ways it can manifest itself may be determinants of bonding disorders.

Depression and anxiety have often been found to be associated with parental attitudes towards children. Parents with depression are more likely to exhibit psychomotor retardation and also to be irritable (Downey and Coyne 1990). Depressed mothers were found to be more likely to respond destructively (defined as using criticism, scolding,

threatening, withdrawing privileges, and aversive physical control with the intent of stopping the child's behaviour) in a free-play task with a 16- to 18-month-old child (Caughy et al. 2009). Thus, dysphoric mood may also contribute to the development of bonding disorders. Nagata et al. (2003) developed a measure of maternal attachment and studied mothers of one-year-old children. Their measure had two subscales, core maternal attachment and anxiety regarding children, and both were correlated with mothers' depression. Moehler et al. (2006) and Edhborg et al. (2011) also reported that maternal depression was correlated with lower quality of maternal bonding for the period of several weeks after childbirth. These studies, however, did not investigate the association between depression and bonding failure in children older than infants.

While bonding is a parental attitude towards a child, it may be associated with the parents' attitudes towards adults, including marital partners. Among Japanese couples with one or more children, wives whose husbands treated them affectionately were found to be more likely to exhibit affectionate child-rearing styles; wives whose husbands treated them with an controlling attitude were more likely to demonstrate overprotective child-rearing styles; and finally, husbands whose wives acted in controlling ways towards them tended to be less affectionate and more overprotective with their adolescent children (Lu et al. 2008). Marital attachment is an affectionate tie towards one's partner. Therefore, we hypothesized that an individual's adult attachment style towards their intimate partner may be a determinant of bonding disorders. Bienfait et al. (2011) reported that maternal adult attachment did not differ between mothers with or without bonding difficulties, but the mothers they studied were only 3 days postpartum.

Thus, we were interested in whether bonding disorders were associated with variables including demographic, intrapersonal (such as anger, depression, and anxiety), and interpersonal (particularly adult attachment). These determinants of bonding disorders are likely to be intercorrelated. For example, parents with insecure attachment to their partners would be more likely to experience depression and anxiety. They may also feel anger towards others. The links between anger and both depression and anxiety disorder have previously been recognized. When studying the above-mentioned causal paths, we paid attention to gender differences between parents. It is recently that fathers and mothers are studied separately and are compared with one another in terms of parent-child interactions and other mental health issues. As was done with the factor structure of the MIBS, we examined whether the causal paths from several determinants to impaired bonding would vary between fathers and mothers.

Thus, the aims of this study were (a) to examine the MIBS factor structure and possible differences when

administered to Japanese fathers as well as mothers and (b) to examine possible determinants of bonding disorders.

Method

Participants

This questionnaire survey was conducted in collaboration with the Kumamoto Paediatric Association in 2002. As a result of our solicitation to the members of the Association, 20 clinics out of all the 41 clinics agreed to participate in the study. Paediatricians handed the questionnaire to the parent(s) of each child aged <11 years who visited the clinic. Thus, the present sample was convenient. All the participating clinics provided generalized child care. None of them was specialised for particular paediatric conditions such as developmental disorders. In Japan, serious cases of children's diseases are referred to specialised institutions such as university hospitals. Therefore, most of the children in this study were unlikely to be suffering from serious medical conditions. Paediatricians handed the questionnaire to the parent(s) of each child under age 11 who visited the clinic. The parents were asked to enter the study, and if they agreed, they were given one or two additional questionnaires so that each partner had a copy. Fathers and mothers were asked to fill out the questionnaires independently of each other. The total number of families who participated in the questionnaire survey was 759. However, only 396 fathers and 733 mothers returned the filled-in questionnaires. In 357 families, both parents returned the completed questionnaire. The mean (SD) ages of the fathers and mothers were 35.0 (6.5) and 33.3 (5.6) years, respectively. The fathers were significantly older than the mothers ($p < .001$). Most of the parents (94 % of the fathers and 94 % of the mothers) were married or cohabiting. The mean age (SD) of the children was 3.3 (2.7) years with a range between 0 and 10 years. There were 390 boys (51.4 %) and 346 girls (45.6 %). The gender was unknown for the remaining 23 children (3.0 %).

Ethics

This research project was approved by the Ethical Committee of the Kumamoto University Graduate School of Life Sciences.

Measurement

Parental Bonding with the Child

The Japanese version of the MIBS (Yoshida et al. 2012) was used. The original English scale consists of 10 items

with a four-point (1 = “not at all” to 4 = “very much”) Likert scale. Some are reverse items. Higher scores indicate greater negative attitudes towards the child. Although items with factor loadings of <.3 (items 4 and 9) were excluded from the Japanese version (Yoshida et al. 2012), we used all 10 items of the Yoshida et al.'s (2012) version in order to re-examine the factor structure of the scale in a different population.

Parental Dysphoric Mood

The Japanese version of the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith 1983; Kitamura 1993) was used. This scale measures cognitive symptoms of depression and anxiety. It consists of 14 items; the Anxiety and Depression subscales each include 7 items. The HADS is unique in that no items refer to somatic symptoms. Each item is rated from 0 (low depression or anxiety) to 3 (high depression or anxiety), and the total score can range from 0 to 21, with a higher score indicating more severe symptomatology. The HADS has been widely used in clinical and non-clinical populations and its reliability and validity have been well established (Mykletun et al. 2001; Matsudaira et al. 2009). The Cronbach's α coefficients in this study were .713, .738, .715, and .732 for fathers' and mothers' Anxiety, and fathers' and mothers' Depression, respectively.

Trait Anger and Anger Expression

The Japanese version (Suzuki and Haruki 1994) of the state-trait anger expression inventory (STAXI; Spielberger 1988) was used. This is a self-report measure of state and trait anger and anger expression. The original STAXI consists of 44 items with 5 subscales—State Anger (10 items), Trait Anger (10 items), Anger-In (8 items), Anger-Out (8 items), and Anger-Control (8 items). However, for the sake of brevity given the overall length of the questionnaire, we excluded all the State Anger items and shortened the Anger-In, Anger-Out, and Anger-Control subscales to three items each. For each of these scales, we selected the three items that had the highest factor loadings in an exploratory factor analysis (EFA) of the STAXI in a Japanese population (Suzuki and Haruki 1994). Possible scores ranged from 0 to 30 for Trait Anger and from 0 to 9 for Anger-In, Anger-Out, and Anger-Control. Missing values for STAXI items were substituted with the mean of the score of each item only for those cases with less than 16 missing items (20 % of the total). The Cronbach's α coefficients in this study were .850, .857, .664, .696, .695, .640, .683 and 610 for fathers' and mothers' Trait Anger, fathers' and Mothers' Anger-In, fathers' and mothers' Anger-Out, and fathers' and mothers' Anger-Control, respectively.

Adult Attachment Style

The Japanese version of the Relationship Questionnaire (RQ; Bartholomew and Horowitz 1991; Matsuoka et al. 2006) was used. This scale measures participants’ attachment to close adult peers (or in this study, their partners) by means of four paragraphs describing the four adult attachment styles (Secure, Fearful, Preoccupied, and Dismissing). Agreement with each description was rated using a 7-point scale from 0 (does not apply to me at all) to 6 (applies to me very much). The RQ has been reported to have good reliability (Bartholomew and Horowitz 1991) and validity (Griffin and Bartholomew 1994). In accordance with Bartholomew and Horowitz (1991), we created as composite variables the Self-Model and Other-Model, defined as follows:

$$\text{Self-Model} = \text{Secure} - \text{Fearful} - \text{Preoccupied} + \text{Dismissing}$$

$$\text{Other-Model} = \text{Secure} - \text{Fearful} + \text{Preoccupied} - \text{Dismissing}$$

Statistical Analyses

First, the participants ($n = 1,129$) were randomly split into two groups. Using the first group (Group 1, $n = 564$), we performed an EFA on the 10 MIBS items for fathers and mothers separately. The number of factors was determined by scree plot (Cattell 1966). Oblique rotation was performed with the Promax method. From the results of the

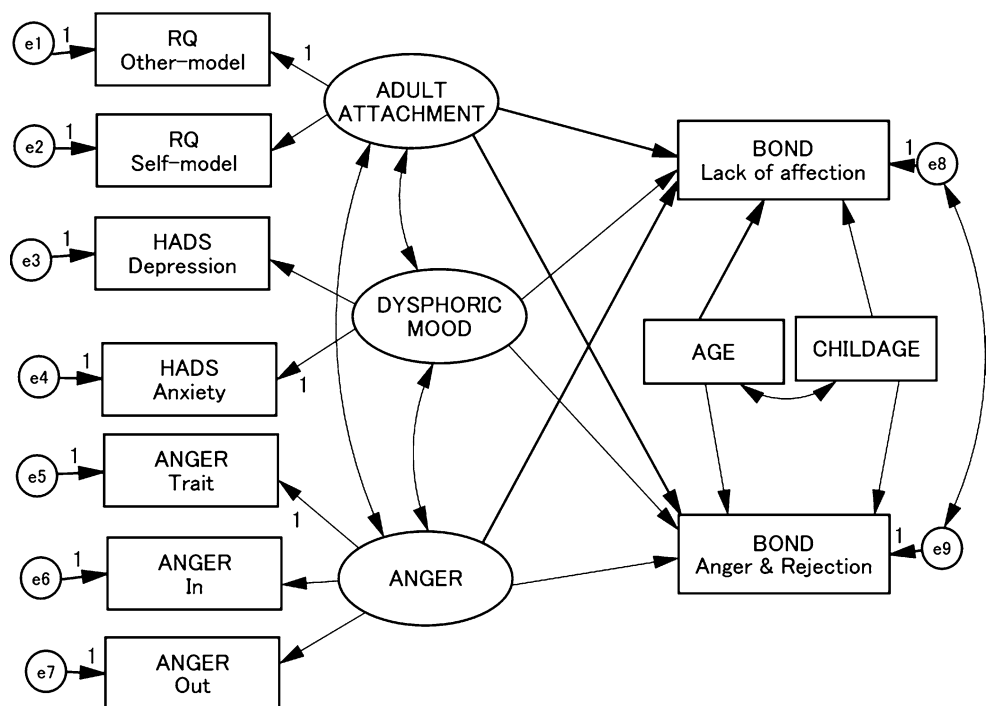
EFA, we created subscales consisting of items for which the loading on each factor was .3 or higher.

Second, we cross-examined the factor structure extracted from the EFA using confirmatory factor analysis (CFA) of the second group (Group 2, $n = 565$). Because we were interested in parents’ gender differences in terms of the MIBS factor structure, a multiple-group analysis was used to test the equivalence of MIBS item factor structures in mothers and fathers.

The new subscales derived from the EFA were correlated with predictor variables in order to examine whether the determinants of bonding with the child were different in mothers and fathers. They included (1) demographic variables (parental age, and child’s age and gender); (2) intrapersonal variables (trait anger and expression, and dysphoric mood, including depression and anxiety); and (3) interpersonal variables (adult attachment styles). Due to the use of multiple comparisons, the significance level was set at $p < .05/10 = .005$ (Bonferroni correction). For this analysis, we used the total population ($n = 1,129$).

Because the above predictor variables were found to be correlated with each other, we examined them in a path model using structural equation modelling (SEM) (Fig. 1). Here we hypothesized the following latent variables: Adult Attachment, composed of Self-Model and Other-Model; Dysphoric Mood, composed of Depression and Anxiety; and Anger, composed of Trait Anger, Anger-In, and Anger-Out. Anger-Control was excluded from the last latent variable because of its lack of association with the other three STAXI subscales. The three latent variables

Fig. 1 Original path model of the parental MIBS subscales with their potential predictor variables



representing the participants’ current intrapersonal and interpersonal characteristics were hypothesized to be associated, and we therefore set covariances between their error variables. Children’s and parents’ ages were hypothesized to be correlated with each other and to predict the MIBS subscales. Because a bivariate analysis indicated a correlation between the MIBS subscales, we set a covariance between these subscales’ error variables. A multiple-group path analysis was performed to determine whether path patterns differed for fathers and mothers.

In order to improve the model’s fit with the data, modification indices were used and new covariance estimates were consecutively added to the path model. We paid most attention to whether the suggested modifications made theoretical or common sense (Arbuckle and Wothke 1955–1999, p. 153). X^2/df , comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used as goodness-of-fit indices. According to conventional criteria, $X^2/df < 3$, CFI $> .95$, and RMSEA $< .08$ indicate an acceptable fit, while $X^2/df < 2$, CFI $> .97$, and RMSEA $< .05$ indicate a good fit (Bentler 1990; Schermelleh-Engel et al. 2003). All statistical analyses were conducted using the Statistical Package for Social Science (SPSS) version 20.0 and Amos 20.0.

Results

Means and SDs and Factor Structure of the Japanese MIBS Items

As shown in Table 1, the means of several MIBS items in Group 1 were very low. Most of the items were positively skewed. We therefore log-transformed all the MIBS scores before entering into the EFA. The scree test suggested a two-factor structure. In both fathers and mothers, the MIBS items with a high factor loading on the first factors reflected parents’ affection and care towards the child. As in the study of Yoshida et al. (2012), the factor loadings of Items 4 and 9 were $< .3$. While the factor loadings of Items 2 and 7 barely reached $.3$, the items were retained in the CFA because in both items the factor loadings in mothers were around $.3$ or more. The resulting two factors were the same as those identified by Yoshida et al. (2012). The LA factor included four items: Items 1, 6, 8, and 10. The AR factor included four items: Items 2, 3, 5, and 7.

The factor structure extracted in the EFA of the MIBS was then subjected to a CFA using Group 2. A multi-group CFA showed no difference between fathers and mothers. Figure 2 shows the CFA model using the combined participants (i.e., fathers and mothers) in Group 2. The model structure derived from the EFA showed good fit with the data (CFI = $.956$, RMSEA = $.033$, CMIN/df = 1.85). The

Table 1 Means and SDs of Mother-Infant Bonding Scale items and factor structure ($n = 396$ for fathers, 733 for mothers)

No	Items	Mean (SD)	Skewness after transformation	Factor	
				I	II
1	I feel loving towards my child	3.6 (.6)	−2.20	.55	.15
		3.6 (.6)	−2.30	.55	.15
2	I feel scared or panicky when I have to do something for my child	1.7 (.7)	.09	.00	.14
		1.7 (.6)	.14	−.12	.28
3	I feel resentful towards my child	1.6 (.6)	.01	−.05	.76
		1.8 (.6)	.06	−.03	.69
4	I feel nothing for my child	1.1 (.4)	4.35	.37	.07
		1.1 (.3)	4.47	−.23	.18
5	I feel angry with my child	1.5 (.6)	.49	.09	.62
		1.6 (.7)	.49	−.13	.72
6	I enjoy doing things with my child	3.1 (.8)	−1.46	.58	.08
		3.2 (.7)	−1.36	.66	−.14
7	I wish my child is different	1.3 (.6)	2.24	.10	.20
		1.4 (.6)	2.22	−.03	.69
8	I feel protective towards my child	3.7 (.7)	−3.90	.76	−.14
		3.8 (.6)	−3.97	.86	.19
9	I wish I did not have my child	1.1 (.3)	6.38	.16	.07
		1.1 (.4)	6.02	−.06	.56
10	I feel close to my child	3.7 (.7)	−3.55	.73	.08
		3.8 (.5)	−3.65	.72	.10

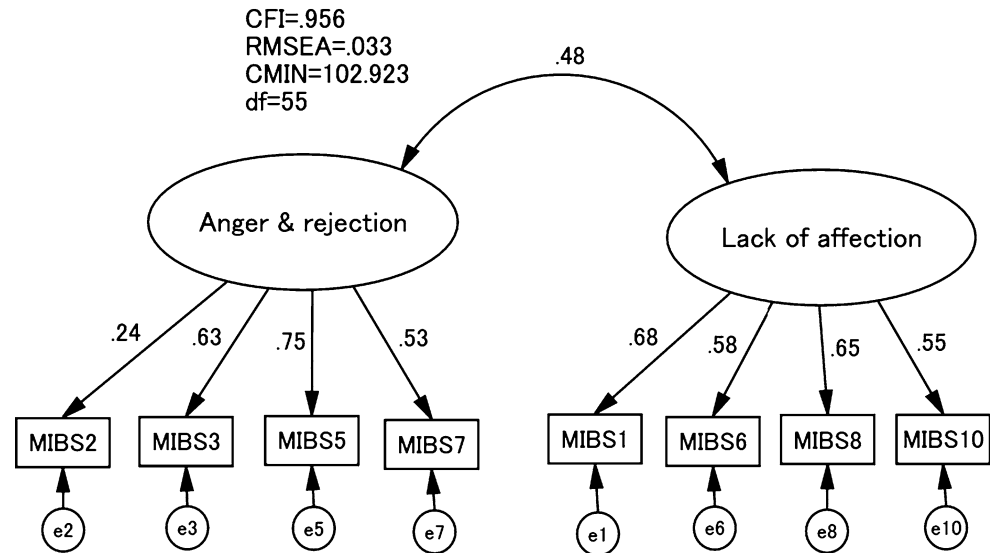
Upper figure in each cell represents factor loading (or total variance explained) among fathers, whereas lower figure in each cell represents factor loading (or total variance explained) among mothers. Item scores after log transformation were entered into the exploratory factor analysis. Factor loadings $> .3$ are in bold. Each score can range from 1 (not at all) to 4 (very much). No items were reversed

correlation between the LA and AR factors was moderate ($r = .48, p < .001$).

Hence we defined two MIBS subscales: LA and AR. Their scores were calculated by adding the scores of each of the two respective factors. Higher LA scores represent less parental affection and care towards the child, while higher AR scores represent greater parental anger and hostility towards the child. Although the Cronbach’s α values of the LA subscale were $.722$ in fathers and $.721$ in mothers, for the AR subscale these values did not reach the acceptance criteria ($> .70$) either in mothers ($.481$) or fathers ($.612$).

Correlates of the MIBS Subscales

In fathers, LA was not correlated with any variables whereas AR was correlated with the RQ’s Self-Model and

Fig. 2 Confirmatory factor analysis of the MIBS**Table 2** Correlates of fathers' and mothers' MIBS subscales

	Mean (SD)	Cronbach's α	Lack of affection	Anger and rejection
<i>n</i>	396			
	733			
Parental age	35.4 (6.1)	–	–.16	.05
	33.3 (5.5)		–.04	.14*
Child's age	3.4 (2.8)	–	.03	.17*
	3.6 (2.7)		–.09	.21***
Child's gender (boy 1; girl 2)	1.5 (.5)	–	.03	.16*
	1.7 (1.4)		–.02	.09
HADS depression	4.0 (2.8)	.62	.15*	.17*
	5.2 (3.6)	.74	.27***	–.29***
HADS anxiety	4.6 (3.1)	.68	.10	–.02
	5.1 (3.5)	.72	.28***	.21***
STAXI trait anger	13.7 (5.2)	.84	.14	.06
	15.3 (4.7)	.84	.41***	.18**
STAXI anger-in	4.3 (1.8)	.67	.02	.02
	4.2 (1.9)	.72	.27***	.26***
STAXI anger-out	3.6 (1.9)	.73	.18*	.03
	3.9 (1.8)	.61	.26**	–.00
RQ self-model	2.9 (2.7)	–	–.10	–.28***
	2.6 (3.3)		–.23***	–.17**
RQ other-model	3.0 (2.9)	–	–.06	–.32***
	3.3 (3.2)		–.04	–.18**

Upper figure in each cell represents data among fathers whereas lower figure in each cell represents data among mothers. * $p < .05$; ** $p < .01$; *** $p < .001$. Correlations whose p value $< .005$ (Bonferroni correlation) are in bold

Other-Model (Table 2). On the other hand, mothers' LA was correlated with Depression, Anxiety, Trait Anger, Anger-In, Anger-Out, and the RQ's Self-Model. Mothers'

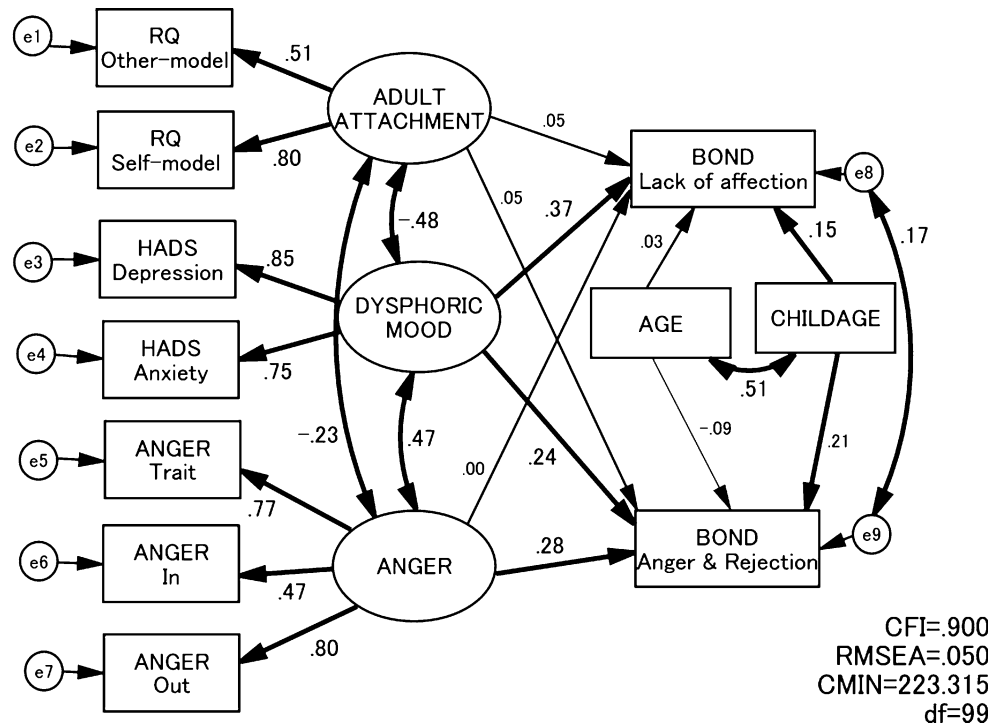
AR was correlated with child age, Anxiety, Depression, Trait Anger, Anger-In, and the RQ's Self-Model and Other-Model.

Because many of the predictor variables were intercorrelated (data not shown) and we theorized that some predictors exerted their effects earlier than others in time sequence, we performed path analyses using multi-group SEM for fathers and mothers, but found no differences between the two (Fig. 3). LA was directly predicted by only Dysphoric Mood ($\beta = .26, p < .001$), whereas AR was predicted by Dysphoric Mood ($\beta = .16, p < .001$) and Anger ($\beta = .12, p < .001$). Adult Attachment, Dysphoric Mood, and Anger were correlated with each other; however Adult Attachment did not predict either LA or AR. While the parental age was correlated moderately with the child's age, only the latter was associated with LA and AR.

Discussion

An EFA and CFA of the Japanese MIBS items yielded a robust two-factor structure. The first factor (LA) represents parents' lack of affectionate and caring attitudes towards the child. A high LA score suggests coldness and loss of interest in childcare. The second factor (AR) represents anger and negative feelings towards the child. Our results were virtually the same as those of Yoshida et al. (2012), who studied only mothers. We derived the same two-factor structure with fathers as with mothers. Whereas Yoshida et al. (2012) focused on mothers of one-month-old infants, our sample included parents of older children. The fact that our two studies described virtually the same MIBS factor structure suggests that the scale can be used with both mothers and fathers and with children over a wide age range. Another unique finding of this study was the

Fig. 3 Path model of perceived adult attachment to the partner, dysphoric mood, and anger on the two MIBS subscales in parents. Statistically significant paths are in *bold* with a standardized path estimate. Non-significant paths are in *grey* with no path estimate shown



moderate correlation between LA and AR (Fig. 2). This showed that affection for one’s child is not the opposite feeling as anger or rejection. It is interesting that the women with intense anger and rejection do not necessarily have lack of affection.

An additional topic of the present study was how parental bonding and bonding disorders develop. We tried to make a case that parental bonding would be predicted by current intra- and interpersonal factors. Results of the multi-group path analysis showed no difference between fathers and mothers (Fig. 3). Parental bonding difficulties, particularly Anger and Rejection, were associated with the older age of the child. These findings suggest that although the factor structure describing parental bonding with the child is stable regardless of child age, parents are more likely to experience bonding difficulties as the child gets older. This should be examined in the light of the child’s temperament and problem behaviours because the latter are more likely to appear among older children.

A third important finding of this study was that parents with higher dysphoric mood (depression and anxiety) were more likely to feel lack of affection, anger, and rejection towards their child. This is in line with the studies of Nagata et al. (2003) and Moehler et al. (2006). Clinicians and educators counselling parents on their rearing behaviours may be advised to pay more attention to parents’ mood (depression and anxiety) as the possible cause of parental lack of affection, anger, and rejection.

In contrast to dysphoric mood, which was also associated with lack of affection, parental anger predicted only

anger towards and rejection of their child. This result is significant because it suggests that parents who struggle with anger or irritation may indeed feel angry with their child while still experiencing affection for them. Although parental dysphoric mood and anger were moderately correlated with each other, they showed differential associations with parental bonding. Hence parental anger traits may deserve attention in clinical settings when treating parental bonding disorders and educating parents about them. Adult attachment was not associated with lack of affection, anger, or rejection. However, it may be associated with these variables through its significant correlation with dysphoric mood and anger.

What is important about the MIBS is its validity (Cronbach and Meehl 1955). Concept of validity includes content validity, criterion-oriented validity, and construct validity. Content validity is justified by the fact that the test items are a sample of a universe in which the investigator is interested. We believe that the items used in the MIBS are fair representatives of what clinicians consider as parent-to-child bonding and bonding difficulties. Criterion-oriented validity consists of predictive and concurrent validity. The scores of the MIBS are significantly correlated with some other measures of bonding and bonding difficulties such as the PBQ and the Maternal Postpartum Attachment Scale (Wittkowski et al. 2007; Van Bussel et al. 2010). When no criterion or universe of content is accepted as entirely adequate to support the test’s validity, construct validity is to be investigated (Cronbach and Meehl 1955). We showed in this study

that two subscales of the MIBS were differentially correlated with parental anger. In our previous study, we found that boding high MIBS scores 5 days after childbirth were associated with abusive parenting 1 month after childbirth (Kitamura et al. 2004). More information is need to establish convergent and discriminant validity (Campbell and Fiske 1959).

Several limitations of this study should be noted. First, the present sample was a convenient one and was not representative of the population in question. Caution should also be exercised because this was a cross-sectional study. Causal relationships may be the opposite to those hypothesized, for example with bonding difficulty leading to parental feelings of guilt as well as dysphoric mood. This is a limitation of our study design, and prospective studies are needed before definitive conclusions can be made. Second, this study used a non-clinical population in whom the degree of bonding difficulty may have been relatively mild. A clinical population may present a different picture, with a small proportion of people that might be identified as discretely pathological. A third drawback is that parents assessed their own psychological characteristics, making shared observer bias inevitable. We also had no opportunity to evaluate the childhood temperament and behaviour problems that may have led to parental bonding difficulties. The nature of parent–child interactions and their attitudes towards one another are reciprocally related. While parental anger may lead to abusive parenting, parents' emotions may be determined at least in part by their children's temperament and behaviour (Lengua and Kovacs 2005; Brockington 2011). For example, mothers of children with infant colic are more likely to have bonding difficulties (Yalçın et al. 2010). As seen from Table 2, internal consistency of correlates of MIBS subscales measured by Cronbach's α was generally low, ranging between .61 and .84. Bland and Altman (1997) noted that α values of .7 to .8 were regarded as satisfactory for comparison groups but much higher values such as $>.9$ were needed for clinical application. Hence we should be cautious when applying the results in a clinical setting. Finally, we left possibly many other variables that may determine the bonding disorders. We failed to address unwanted pregnancy (Brockington 1996, 2011; Kokubu et al. 2012) as well as attachment to the foetus as such candidates. These issues should be examined in future studies on the determinants of parental bonding.

Taking into consideration these methodological shortcomings, the present study suggests that the MIBS has two subscales that can be predicted by intrapersonal and interpersonal variables, and may provide information applicable to the design of therapeutic or preventive approaches to parents with bonding disorders.

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Conflict of interest All the authors declare that there are no conflict of interests.

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