Variations in Early Attachment Mechanisms Contribute to Attachment Quality: Case Studies Including Babies Born Preterm

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Abstract

Three boys (an extremely preterm, a moderate preterm twin and a full-term toddler; all 12 to 15 months old) were selected from a large sample to investigate mechanisms of parent-child attachments, specifically of babies born preterm. Attachments were observed at home with the Attachment-Q-Sort (AQS) as well as in the lab with the Strange Situation (SS). Both AQS and SS were used twice for each boy, separately with his mother and father. Whereas the SS was efficient in analyzing basic attachment repertoire, levels of arousal and its regulation, the AQS depicted general characteristics of the attachments. Results revealed constraints in use and provision of the secure base function which were only able to be demonstrated in the SS for father-child dyads of the preterm boys. This suggests that restriction in attachment repertoire, as well as inadequate paternal responses, led to descriptions of insecure attachments, whereas AQS-based assessments of the same dyads showed secure attachments.

Keywords

Father, attachment, preterm, arousal, regulation, cortisol

Attachment, the bond formed between infants and their caregivers, has an enormous impact on the patterns of childrearing and consequently on child development. Although infants are biologically predisposed to develop attachment relationships with their caregivers based on an innate behavioral repertoire, attachments have to be fully formed in interactions with the caregivers over time. Over the course of the first year of life, the child should thus have consolidated and developed an attachment repertoire and should have learnt how to use caregiver's behaviors as a secure base in times of stress (Bowlby, 1988). Using a caregiver as a secure base, however, might develop stepwise in four stages (Bowlby, 1969), i.e., (1) after a pre-attachment phase, during which an infant starts discriminating one person from another, s/he (2) orients and directs signals towards the discriminated figure(s) and continues to behave towards people in the same friendly way as previously, but does so in a more marked fashion towards her/his attachment figure(s) than towards others. Around six months of age, (3) the child starts to follow her/his attachment figure(s) in order to maintain proximity and uses them as a base to explore. At the end of the first year, finally, (4) a goal-corrected partnership has emerged by which, for example, the child understands the secure base function of his attachment figure's behaviors, and takes advantage of this.

Behaviors such as crying, clinging, smiling are predisposed innate components of the attachment repertoire and most of them are easily applicable to infants born at term but difficult for preterms. For example, preterm babies often not only suffer from life-threatening complications such as respiratory distress, they are also faced with limitations in their behavioral repertoire because of the immature brain functioning (Gutbrod & Wolke, 2003; Pipp-Siegel et al., 1999). Not surprisingly, social adaptations to the environment might be difficult for preterm babies.

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Early research has already shown that the onset of social smiling is significantly delayed in preterm as compared to term infants (Anisfeld, 1982). Moreover, preterm infants vocalize and look at their caregivers less often than full-term infants, and avert their gaze more often in social interactions (e.g., De Schuymer et al., 2012).

In addition, preterms are known for being highly susceptible to stress (e.g., Buske-Kirschbaum et al., 2007), even though they are harder to comfort at the same time. Poor self-regulation (Clark et al., 2008) obviously makes them dependent on environments that help them to develop effective strategies to specifically handle stressful situations. Unfortunately, preterm children seem to be less approachable (Hughes et al., 2002) as they are described as less responsive and more irritable, which generally requires more patience and aptitude from caregivers (Forcada-Guex et al., 2006; Goldberg & DiVitto, 2002; Muller-Nix et al., 2004). In a meta-analysis of 34 studies, Bilgin and Wolke (2015) found no differences in sensitivity between mothers of preterm and term toddlers, even though Goldberg and DiVitto (2002) argued that delays in reaching developmental milestones might cause concerns about potential handicap, and might therefore contain a dynamic potential to impair daily social interactions.

Thus, infants born preterm have been seen to be at higher risk of developing less optimal patterns of attachment (for an overview see Buchheim et al., 1999; Brisch et al., 2005; Wolke et al., 2013), even though results were inconsistent. For example, whereas a meta-analysis carried out by Korja et al. (2012) found no difference in mother-child attachment between preterm and term children as classified by the A-B-C categories of the Strange Situation (Ainsworth et al., 1978), Wolke et al. (2013) only found differences when disorganization was coded for (Main & Solomon, 1990).

Furthermore, none of the reported studies included fathers. While mothers appear as principal caregivers, especially for preterm babies, health professionals in modern neonatal units of the hospitals encourage fathers to attend to these babies too. They refer to studies, for example, about kangaroo care which have proved positive effects on both the infant's emotional state and parental sensitivity (Feldman et al., 2002, 2003; Tallandini & Scalembra, 2006). However, there is much less known about paternal than maternal care of preterms, and whether and how patterns of a preterm's relationship towards his mother diverge from the relationship towards his father.

The aims of the current study are thus two-sided: (1) to provide qualitative information about attachment capacities based on cases of preterm as opposed to full-term infants, and (2) to explore paternal (beside maternal) characteristics of these individual relationships. Firstly, we will give insights into general characteristics of mother-child and father-child attachments as observed at home and in the laboratory. We will thereby describe how children interact with their parents, seek attention and comfort, and show their emotional needs. Secondly, we will focus on the variations of child emotional arousals but also the potentials of emotional regulation in preterm and term children. We will finally discuss whether and how these children use the attachment relationship to cope with distress and everyday challenges at home. Excluding gender effects, we have chosen three boys from a larger sample because preterm males are considered more vulnerable than females (Brothwood et al., 1986), as this is reflected by some postnatal indicators such as lower Apgar scores (Peacock et al., 2012; Stevenson et al., 2000).

Method

Overall Information

A sample of $N = 245$ ($n = 100$ preterm singletons, $n = 45$ preterm twins, $n = 100$ full-terms) healthy toddlers served as a source from which the three boys, Alexander, Paul, and Max, were randomly selected out of the respective subsamples. However, certain inclusion criteria such as age between 12 and 18 months and typical AQS-scores for the respective subsample (see Table 2) were applied. We visited each boy at home on two different days for a 2-hour observation using the Attachment Q-Sort (AQS; Waters, 1995), once with the mothers and once with the fathers, allowing a time period between the two visits of $M = 16.7$ ($SD = 14.3$) days. In addition, mothers and fathers were invited separately with their boys to the lab in order to carry out the Strange Situation (SS; Ainsworth et al., 1978), with time intervals of $M = 135.7$ ($SD = 73.5$) days.

Participants

Alexander

He was born healthy and at term during the 39th week of gestation with 3300 grams and 51 cm. Two

Table 1
Birth Characteristics and Family Situations of the Three Boys

	Age[a]	GA[c]	Weight[d]	Length[e]	Family Situation	
					Mother	Father
Alexander	15;29	39;6	3300	51	Exclusively at home	More than fulltime work as manager
Paul	13;08[b]	24;5	460	28	Some work	Full-time work as craftsman
Max	13;29[b]	34;3	2200	44	Exclusively at home	Flexible full-time work as teacher

Note. [a]Age in months at the time of the Strange Situation. [b]Age adjusted for prematurity. [c]GA = Gestational age in weeks and days. [d]Weight in grams. [e]Length in cm.

days after birth, he and his mother were discharged home. His mother was still at home when Alexander joined the study at 15 months of age. Alexander had two older half-sisters from the father's first marriage. Both sisters did not live in the same household but frequently visited their father's new family. Alexander's father complained of being very busy as a sales manager, but tried to spend as much time as possible with Alexander (see Table 1).

Paul

He was born in the 24th week of gestation with 460 grams and 28 cm, therefore classified as extremely preterm and at high-risk (see World Health Organization, 2015). His mother's pregnancy was uncomplicated until her amniotic sac burst in the 23rd week of gestation. Paul spent four weeks in the neonatal intensive care unit in an incubator, experiencing several health problems, such as heart dysfunctions, breathing restrictions and vision problems, which were treated and cured by surgery, medication and laser therapy. Paul's mother already provided kangaroo care at the neonatal unit until he was transferred to the intermediate care unit of the hospital, where his mother was even more actively involved in caring for him. In contrast, Paul's father only had a few days to look after him before Paul left the hospital (at four months of age). The family joined the study when Paul was 12 months old, and his mother stayed at home with him as an only child. Once a week, his grandparents took care of him so that his mother could work at her former employer as a hairdresser (see Table 1).

Max

He was born as the first of identical twins, in the 34th week of gestation with 2200 grams and 44 cm. His mother had been trying to get pregnant for almost two years and eventually underwent *in-vitro* fertilization. Because of heightened risk of miscarriage,

Max' mother was admitted to the hospital in the 33rd week of gestation. After seven days, she delivered via a Cesarean section. Max and his brother spent two days in the neonatal intensive care unit and 11 days in the intermediate care unit of the hospital, where both parents provided kangaroo care. Later on, Max' father was available to take care of the children due to the flexible work arrangements as a teacher, while Max' mother exclusively stayed at home. Max joined the study at 12 months of age (see Table 1).

Measures

Attachment Assessments

Two measures assessed parent-child attachments capturing different aspects of the relationships (Ahnert et al., 2006): (1) The Attachment Q-Sort (AQS: Waters, 1995) described the attachment quality in diverse situations of the child's daily life on a continuous scale ranging from -1.0 to $+1.0$. Two observers conducted the observations of the parent-child attachment independently for at least two hours with high interrater correlations of $r = 0.92$ (AQS with the mothers) and of $r = 0.94$ (AQS with fathers) in the entire sample. (2) The Strange Situation (SS: Ainsworth et al., 1978) captured parent-child attachment as a lab procedure, which consists of eight 3-minute episodes, including two separations and two reunions of the parent and their child. The procedure activates the child's attachment system and elicits the child's attachment repertoire, the degree of arousal and levels of emotion regulation with or without the attachment figure. The attachments were classified according to A-B-C-D categories (Ainsworth et al., 1978; Main & Solomon, 1990) by coders with at least 85% agreement after the A-B-C training, which was adequate, as the few D-features did not justify for a D-classification. When a subsample of all SSs was double-coded to assess interrater-reliability, there was a substantial agreement on the ABC classification of $\kappa = 0.71$, using Cohen's kappa.

Arousal and Regulation Assessments

We used behavioral indicators as well as physiological indicators, such as cortisol, during the Strange Situation to capture the children's arousal and regulation.

Arousal as Related to Behavioral Scores

For the coding of levels of arousal, we focused on episode 6 (= child alone) and episode 7 (= child with stranger) using two five-point Likert scales: (1) The arousal scale captured irritation, tension, desperation and anger. Coders rated frequency and level of arousal from one to five (1 = no signs of excitement to 5 = very high arousal, desperate). Almost 70% of the codings were double coded. Interrater agreement using Kendall's Tau was excellent with $r_\tau = 0.86$.

Regulation as Related to Behavioral Scores

The regulation scale assessed the capability for self-regulation of arousal in episode 6 (= child alone), episode 7 (= child with stranger) and episode 8 (= child's reunion with the mother or father). The scores we used ranged from one to five (1 = unable to control arousal, state of shock, 2 = occasional attempts of regulation, 3 = some signs of regulation, 4 = good regulation, 5 = excellent and effective regulation strategies in order to calm down). Interrater agreement using Kendall's Tau was excellent with $r_\tau = 0.79$.

Arousal and Regulation as Related to Cortisol Levels

We also indicated levels of arousal through saliva cortisol which was collected three times in the context of the SS: 15 minutes before (baseline measure), as well as 15 and 30 minutes after the SS was over. To provide saliva, the children sucked directly on sterile cotton pads, which were frozen to minus 22 degrees Celsius and later analyzed in the laboratory of the Technical University of Dresden. Using 10 µl saliva samples, inter- and intra-assay reliability ranged from 7 to 10% in cortisol concentrations of 0.4 to 0.7 µg/dl.

Results

Case Selection

The attachment qualities of the three boys represents the respective subsample of the study from which they were selected, because their AQS scores with their mothers and fathers fit the distribution of these subsamples perfectly, with the exception of Alexander whose AQS score with his mother resulted high above the mean (see Table 2).

General Attachment Characteristics as Observed with the AQS

Alexander appeared playful with his mother. He shared toys with her, wanted her to be part of his exploration, and was also very compliant when the mother gave instructions. Bodily contact seemed to be a significant part of their relationship, so that Alexander enjoyed cuddling while being able to explore his environment. In general, Alexander paid attention to his mother's whereabouts and liked to stay rather close to her. He was friendly and open with his mother as well as other people, but clearly enjoyed interaction with her most. The interaction with his father appeared similar; he loved to be cuddled by him, stayed close to him, asked for help quite often and used him to find new things to do. He was fine when the father left the room, but always made sure that he knew where his father was. Alexander clearly used both parents as a secure base, resulting in high AQS scores (with his mother 0.75, with his father 0.58) above the mean level of the subsample (see Table 2).

Table 2
Attachment Qualities as Captured by AQS and SS

| | AQS | | | | SS | |
| | Mother | | Father | | Mother | Father |
	Score[a]	M (SD)	Score[a]	M (SD)	Patterns[b]	Patterns[b]
Alexander	0.75	0.42 (0.23)	0.58	0.46 (0.23)	B3	B3
Paul	0.41	0.33 (0.20)	0.34	0.29 (0.28)	B2	A1
Max	0.40	0.35 (0.23)	0.36	0.31 (0.24)	B1	C2

Note. AQS = Attachment Q-Sort; SS = Strange Situation. [a]Score = Average AQS-score based on two simultaneous observations. [b]Patterns of attachment are based on classifications according to Ainsworth et al., 1978.

In contrast, Paul preferred to play independently from his mother. He hardly followed her suggestions, although he did not get upset with her. Paul paid attention to her whereabouts, enjoyed bodily contact with her and used her as a secure base which was all reflected by a high AQS score (see Table 2). Paul also seemed aware of his father's location at all times. However, as with his mother, he did not seek much attention and preferred to play alone, although he enjoyed being imitated and laughed when his father teased him. With his father, he was more demanding and cried to get what he wanted from him, so that his AQS score was lower with 0.34 (with his mother 0.41).

Max often stayed close to his mother and looked for her when she left the room, even though he did not seek her attention very much. Playing with his mother though, he enjoyed climbing on her, laughed when she teased him, and enjoyed being hugged. Therefore, the AQS score appeared rather high (0.40, see Table 2). With his father, Max did not actively seek bodily contact, neither in order to cuddle nor to play. However, he mostly explored within close proximity of his father, while finding toys and things to do on his own which justified an AQS score of 0.36. In general, Max paid little attention to his parent's suggestions and instructions.

General Attachment Characteristics as Observed in the SS

Alexander was classified as B3 in the SS with his mother as well as his father using both parents as a "safe base" in times of distress. Upon both reunions, he strongly sought proximity to them and relaxed very quickly (see Table 2).

Although Paul was classified as B2, some features of avoidance were evident with his mother, however only in the first reunion. With increasing distress, he instantaneously approached his mother to be comforted during the second reunion. In contrast, the SS with his father was marked by high avoidance, which made this attachment pattern A1. He failed to greet his father, ignored him and never actively sought interaction (see Table 2).

The preterm twin Max showed some avoidance towards his mother upon reunions, but the relationship in general seemed to be balanced; he therefore classified as B1. With his father, Max displayed mixed feelings when he was about to seek proximity; he often behaved resistant if his father approached him. He displayed anger and had difficulty calming down.

In addition, as Max appeared passive most of the time, we classified him as C2 (see Table 2).

Arousal, Regulation and Attachment Repertoire as Observed in the SS

After Alexander was highly distressed in the separation episodes of the SS with his mother as well as with his father (see Table 3), he actively sought physical contact with his parents and could not be soothed by the stranger (see Table 5). Both Alexander's mother and his father calmed him down, so that he was able to regulate his arousal (see Table 5). This regulation was reflected by a decrease in the cortisol response already half an hour after the SS (see Table 4). Alexander's attachment repertoire was diverse as he smiled and babbled twice as often as the preterm boys during the reunion with his parents.

Table 3
Arousal as Related to Behavioral Scores of Two Episodes of the Strange Situation

	Mothers		Fathers	
	Ep 6[a]	Ep 7[b]	Ep 6[a]	Ep 7[b]
Alexander	5	5	5	5
Paul	5	4	5	5
Max	3	4	5	4

Note. [a]Episode 6 (child is left alone). [b]Episode 7 (child is with the stranger).

Table 4
Arousal and Regulation as Related to Cortisol Levels during the Strange Situation

	Mothers			Fathers		
	Time 1[a]	Time 2[b]	Time 3[c]	Time 1[a]	Time 2[b]	Time 3[c]
Alexander	5.05	4.22	2.82	4.58	4.53	2.64
Paul	0.26	7.51	4.45	2.91	3.35	3.67
Max	7.25	7.83	5.17	2.22	5.19	5.85

Note. [a]Time 1: 15 minutes before the Strange Situation. [b]Time 2: 15 minutes after the Strange Situation. [c]Time 3: 30 minutes after the Strange Situation.

Table 5
Regulation as Related to Behavioral Scores of Three Episodes of the Strange Situation

	Mothers			Fathers		
	Ep 6[a]	Ep 7[b]	Ep 8[c]	Ep 6[a]	Ep 7[b]	Ep 8[c]
Alexander	1	2	4	1	1	4
Paul	2	3	5	1	4	5
Max	3	2	5	1	3	3

Note. [a]Episode 6 (child is left alone). [b]Episode 7 (child is left with the stranger). [c]Episode 8 (child's reunion with the mother or the father).

Paul seemed to be quite distressed when his mother left for the first time, kept busily playing and began to cry after a while. In episodes 6 and 7, he was highly aroused. As the stranger entered, he was visibly upset, even though his arousal decreased when the stranger distracted him with toys. When his mother reentered and responded sensitively to Paul, he returned to playing as reflected by a low cortisol level after the SS (see Table 4). In the SS with his father, Paul seemed most distressed upon being left alone and cried, however not for his father, but interestingly for his mother. He was able to direct his attention towards the stranger and while playing with her; he calmed down on a behavioral level (Table 5). When his father entered, he appeared to be a robust, calm and independent child, though cortisol data showed the opposite pattern, with high levels remaining and reflecting distress (see Table 4). In general, Paul signaled less and hardly ever approached his parents. Apart from a short time at the end when he sat on his mother's lap, Paul seemed withdrawn, lost in playing without vocalizing.

Preterm twin Max did not show arousal in form of crying after being separated from his mother. However, Max adjusted the toys and played with his fingers, staring at the stranger while his face lacked affect. In both reunion episodes, he greeted his mother and interacted with her from a distance. This was mostly apparent in episode 8 even though he moved closer to her aiming to involve her in his play. Although he did not play most of the time but sat with a distance to his mother, tried to get her attention by pointing to toys on the shelf, looked around and smiled. Obviously, he had calmed down, confirmed by the cortisol level at the end of the SS (Table 4). In general, Max tended to be passive and cautious throughout all episodes of the SS. His attachment repertoire appeared constrained. He did not approach his father or initiate interactions with him. The separation was marked by distress and helplessness, and his father could not calm him down (see Tables 4 and 5).

Discussion

The present study provides qualitative information about the attachment repertoires in three boys, one full-term and two preterms, as well as in the children's use and parents' provision of the secure base function. We wondered whether it might be possible to explain inconsistencies in preterm-parent attachments in the current research by using typical cases that we investigated in both a challenging context,

taping attachments in the Strange Situation (SS), and a non-challenging context, taping attachments in every-day situations with the Attachment-Q-Sort (AQS). Thereby, we even relied on two attachment figures (mother and father of a joint child). We aimed to look for systematic differences and similarities in the child's attachments towards his/her parents, and designed the present study to serve as a hypothesis generating investigation.

As a first result, we indeed revealed differences in the characteristics of the attachment repertoire during daily life situations at home when the two preterm boys were compared with Alexander born at term. The two preterm boys, Paul and Max, displayed an attachment repertoire in various ways; they smiled, vocalized, cried, search for proximity and accepted bodily contact. Compared to Alexander, however, these boys displayed a smaller variety of attachment behaviors, specifically when they were to use their parents for exploring and coping with the environment. In that, Paul and Max appeared quite undemanding, but also less compliant as opposed to Alexander. Alexander, in contrast, shaped the relationships with his parents actively to his own advantage by soliciting help and assistance while he shared issues with them. Mainly due to the adequate parental responses during the every-day life situations, all three boys could rely on the functioning of a secure base provided by their parents. Consequently, all three boys displayed secure attachment patterns with their parents when they were observed with the AQS. These findings confirm research by Monteiro et al. (2008) who positively associated security scores across parents in the home environment, even though van IJzendoorn and De Wolff (1997) argued that fathers might shape child attachments to a lesser degree than mothers.

However, the use and provision of secure base behaviors might change in unforeseeable stress-related situations. Therefore, the present study compared the boys' attachment repertoire observed in daily life situations with observations from the Strange Situation. Facing the stress in the Strange Situation, the preterm boys Paul and Max obviously added avoidant or anxious facets to their behaviors instead of integrating the parents' secure base function into their coping strategies as Alexander did. With their fathers specifically, Paul and Max shifted to avoidant or anxious features in the Strange Situation even though they kept security maintaining behaviors with their mothers when mother and child were observed in the SS. Perhaps only fathers appeared to

have difficulties in providing secure base functions under stress conditions.

Clearly, base interactions surrounding the cues of children who tend to negative reactivity, display poorer emotional regulation and are highly irritable (Clark et al., 2008) may need much endurance. If, in addition, these infants minimize or maximize their negative emotions in challenging situations (Sherman et al., 2013), and if they are then less adaptable (e.g., Weiss et al., 2004) and only accept the mother to regulate them, there might be less chances for fathers to aim to adequately support their babies.

But why did fathers foremost have difficulties in adequately understanding and responding appropriately to their children's behavior and needs? The difficulties might account for the fact that fathers regularly spend less time with their children than mothers, but the current case study does not support this explanation. Paul's father was able to invest much more time in the care for his son than Max' or Alexander's father did, and despite this, Paul's father appeared insecure in the Strange Situation, whereas Alexander's father, the busy manager, maintained a secure relationship with his son.

Particularly if children are considered to be vulnerable, fathers might be less experienced in stressful situations, and mothers may fill the role of the protector which could lead to larger differences in the relationship qualities between the two parents taped in the SS than captured with the AQS. When the preterm boys of the present study were analyzed in terms of the cortisol patterns during the Strange Situation, they appeared very aroused with the mothers and at the same time better regulated, suggesting greater awareness of the challenge and openness to cope with it, whereas with the fathers, much suppression could be assumed. Parent-child focused interventions (Brisch et al., 2003; Feldman et al., 2003) should address these issues aiming to facilitate fathers' understanding of the vulnerability of their babies, especially in stressful situations, as vulnerable children depend on caregivers who are sensitive in their responses to their needs (e.g., Wolke et al., 2013).

The present case study also raises questions about how to assess attachment quality in preterm children. Knowing that the child's use and the parent's provision of the secure base function might be impaired, the golden standard should be the AQS and not the SS, which has some shortfalls for these vulnerable children. When preterms face stress, their basal attachment repertoire might obviously become constrained, and they specifically inhibit the use of the secure base of their parents. If we really want to discover the qualities of parent-child relationship in preterms and how they function in the normal environment of the children, we should capture attachments using the AQS. Although we demonstrated typical phenomenon of attachments based on three single cases, quantitative analyses to test the statements raised in this paper are needed for which the entire sample now waits for analyses.

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