Journal of Family Psychology
2003, Vol. 17, No. 1, 94–107

0893-3200/03/$12.00 DOI: 10.1037/0893-3200.17.1.94

Testing a Family Intervention Hypothesis: The Contribution of Mother–Infant Skin-to-Skin Contact (Kangaroo Care) to Family Interaction, Proximity, and Touch

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The provision of maternal–infant body contact during a period of maternal separation was examined for its effects on parent–infant and triadic interactions. Participants were 146 three-month-old preterm infants and their parents, half of whom received skin-to-skin contact, or *kangaroo care* (KC), in the neonatal nursery. Global relational style and micropatterns of proximity and touch were coded. Following KC, mothers and fathers were more sensitive and less intrusive, infants showed less negative affect, and family style was more cohesive. Among KC families, maternal and paternal affectionate touch of infant and spouse was more frequent, spouses remained in closer proximity, and infant proximity position was conducive to mutual gaze and touch during triadic play. The role of touch as a constituent of the co-regulatory parent–infant and triadic systems and the effects of maternal contact on mothering, co-parenting, and family processes are discussed.

The view that families function as unitary systems and are best understood and treated within a systemic perspective has predominated the field of family theory for decades (Epstein, Bishop, & Levin, 1978; Haley, 1964; Minuchin, 1974). In infancy, studies of family interactions have shown important differences between triadic mother–father–infant interactions and parent–infant relatedness, emphasizing the need for a fuller exploration of family-level processes (Belsky, 1981; McHale & Cowan, 1996; Parke & Tinsley, 1987). Yet, research on the triad lags far behind studies on parent–infant relatedness, with very few studies focusing on micro-level assessment of triadic interactions.

One difficulty in the study of family-level processes is the multiple sources of influence impacting on the family system. In defining triadic processes, several levels of direct and indirect influences need be considered. These include: (a) the influence of each individual on the behavior of other individuals (e.g., infant-to-parent) or dyads (e.g., infant-to-marital) in the family; (b) the influence of each dyad (e.g., marital) on the other dyads (e.g., parenting); and (c) the effects of the higher order process on individuals, dyads, and their interrelationships in the family. Such influences may emerge through direct interactions, imitation and modeling, or the effects of other relationships. Spouses shape their parenting behavior in relation to each other during co-parenting, and an improvement in parenting may occur through the observation of a more competent spouse (Belsky, Crnic, & Gable, 1995; Parke, Power, & Gottman, 1979). Similarly, satisfying or distressing marital relationships impact on parenting behavior, particularly the father–child relationship (Parke & Beitel, 1988). Within the context of triadic interactions, moments of shared marital pleasures increase the quality of parenting (Belsky, 1981), whereas distressed marital relationships reduce the level of sensitive parenting, particularly maternal sensitivity (McHale & Cowan, 1996).

Several testable hypotheses on change in family systems may be derived from a systems perspective. First, the systemic nature of the family dictates that intervention targeting one relationship would also affect other individuals, relationships, and the higher order process. For instance, Cowan and Cowan (1992) found that intervention that promotes marital closeness positively impacts the two parenting systems. Second, on the basis of the dyadic-to-triadic influences, gains in one dyadic system are expected to

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This study was supported by the Irving B. Harris Foundation and by a small grant from Kibbutz Maabarot. We express our appreciation to Orit Hacker, Hagit Kahn, Dorit Vardiel, Meir Berbi, Ayelet Shefi, and Hadar Artidi for their help in data collection and coding and to Dee B. Ankonina for editorial assistance. We are most grateful to the mothers and infants who participated in the study.

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persist when these two individuals interact within the triad. Finally, it is likely that the specific gains for the target system following intervention would be expressed in the same domains in the other systems. Thus, if intervention affects the degree of sensitivity or positive affect in the marriage, those same properties would also be enhanced in the two parenting subsystems. Testing these hypotheses is important not only for the evaluation of intervention outcomes in infancy, but moreover, for a fuller understanding of how family systems evolve and function.

In the present study, we used the kangaroo care intervention method as a context for testing these hypotheses. Mother–infant skin-to-skin contact, commonly known as *kangaroo care* (KC), was first used in Bogota, Colombia, as an alternative to incubator care. Premature infants in stable medical condition were placed naked between their mother's breasts for extended periods of time allowing for their body temperature to be regulated by mother's body heat. This care technique was continued until infants matured and could regulate their own temperature independently (Whitelaw & Sleath, 1985). Recently, the KC method was introduced to Western nurseries, wherein parents and preterm infants were encouraged to use the kangaroo position for part of the day as a technique to promote parent–infant attachment (Ludington & Golant, 1993). We hypothesized that the KC intervention—by affording physical contact during a period of maternal separation—would have a positive impact on the mother–infant relationship. Further, due to the systemic nature of the family, we predicted that similar gains would be observed in the father–infant system and in the family process.

Among the negative sequelae of premature birth is the disruption in the attachment process, resulting in part from maternal–infant separation caused by standard incubator care. Maternal separation during the post-birth period exerts a negative impact not only on the infant's physiology and behavior (Hofer, 1995) but also on the mother's tie to her infant. The frequency of maternal affiliative behavior, affectionate touch, and caretaking decrease in the immediate post-birth period following premature birth, partly due to disruptions in the psychobiological process of maternal bonding (Feldman, Weller, Leckman, Kvint, & Eidelman, 1999). Studies comparing the mother's global relational style among preterm and full-term infants found lower levels of maternal sensitivity and adaptation in the preterm group (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983; Greene, Fox, & Lewis, 1983; Minde, Whitelaw, Brown, & Fitzhardinge, 1983). Mothers of premature infants often exhibit an intrusive interactive style (Brachfeld, Goldberg, & Sloman, 1980), which places the infant at a higher risk for deficient social–emotional growth (Minde, 2000). Such a style may result from the premature infant's lower self-regulatory capacities, as well as from the decreased opportunities for mother–infant touch and contact in the first post-birth period (Field, 1996).

Touch comprises one of the central components of the mother–infant co-regulatory system—the process through which mother and infant co-regulate social encounters—although its role has yet to be explored in depth (Tronick, 1995). In a cross-cultural survey on mother–infant interaction, Richter (1995) found that touch, gaze, and affective vocalization were the three interactive components found in all cultural settings, with traditional societies using more tactile contact and Western societies emphasizing more distal modes of co-regulation. The complementary nature of these co-regulatory components may be observed when one or more interactive channel is blocked. For instance, mothers of deaf infants use more touch during play, to compensate for the lack of vocalization (Koester, Brooks, & Traci, 2000), and touch predominates in the interactions of mothers and congenitally blind infants (Urwin, 1984). Using the still-face paradigm, infants typically react to maternal still-face with social withdrawal, whereas when maternal touch is maintained, infants' attention and affect remained unchanged, suggesting that touch can hold the interactive flow when other components are removed (Stack & Muir, 1992).

Mothers of premature infants, unlike those of blind or deaf infants, do not increase the level of touch to compensate for their infants' difficulties in maintaining gaze and affective synchrony; to the contrary, the early separation decreases proximity and touch (Davis & Thoman, 1988). Disruptions in other components of the co-regulatory system have also been observed. Premature infants have difficulties in maintaining visual attention during play (Eckerman, Hsu, Molitor, Leung, & Goldstein, 1999), and their emotional expressions are often unclear (Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). Infants' reduced self-regulation combined with lower maternal contact may lead to the lower level of synchrony observed between mothers and premature infants (Lester, Hoffman, & Brazelton, 1985).

KC may attenuate the negative effects of maternal separation on the mother–child relationship, both in terms of global sensitivity and in relation to micro-regulatory patterns of gaze, affect, and touch. Research in human and animal models has shown that touch and handling during periods of early maternal separation had a positive impact on maternal and infant behavior (Weizman et al., 1999; White-Traut & Nelson, 1988). In premature infants, massage therapy increased the infant's self-regulation (Field, 1995), and when mothers provided the massage, in addition to infant gains in physiological regulation, maternal sensitivity was higher at 3 months of age (Goldstein-Ferber, 1998). Comparing infants carried by slings with those carried by infant seats in the first days of life, Anisfeld, Casper, Nozyce, and Cunningham (1990) found that mothers who maintained closer proximity were more sensitive at 3 months, and their infants were more likely to be securely attached at 1 year. Similar gains are likely to emerge following early skin-to-skin contact. Although little longitudinal data on the impact of KC on parenting is available, KC was found to positively affect maternal emotional state. Following KC, mothers reported more positive feelings toward the infant, lower parental stress, and a better sense of the parenting role (Affonso, Bosque, Wahlberg, & Brady, 1993; Bier et al., 1996). Feldman, Weller, Sirota, and Eidelman (2002) showed that KC promoted the infant's attention and emotion regulation skills at 3 and 6 months. These

gains, in turn, are likely to affect the mother's investment in interactions and reduce the need for intrusive tactics.

What may be the effects of mother–infant skin-to-skin contact on the father–child relationship and the family process? Studies on co-parenting found associations between mothers' and fathers' behavior toward their children, which is thought to lay the foundation for the family process (Belsky et al., 1995; Feldman, 2000; Russell & Russell, 1994). It can therefore be expected that improvements in maternal sensitivity and intrusiveness following KC may also be observed between father and child in the same domains. KC may also positively influence the family-level process. To examine the family process, the present study followed the suggestion of developmental family researchers (Belsky, 1981; Parke & Tinsley, 1987) and assessed both the family's global style and micro-level processes. The global family process was defined in terms of cohesion and intrusiveness. Family cohesiveness, the family's harmonious, sensitive, and synchronous style, is considered a central attribute of a functional family, associated with increased maternal and paternal sensitivity and marital satisfaction (Feldman, Masalha, & Nadam, 2001; McHale, 1995). Family intrusiveness has been associated with higher family conflict and less optimal parent–child interaction (Fincham, 1998; McHale & Cowan, 1996). Microanalysis of the family process focused on the co-regulation of gaze, affect, proximity, and touch between family members. Touch was assessed in relation to the other components of the co-regulatory system, and affectionate touch was differentiated from other forms of instrumental touch. Affectionate touch is unique to parents as compared with caretakers (Miller & Holditch-Davis, 1992), is part of the mammalian maternal repertoire (Insel, 1997), and is considered to be conducive to the infant's physical, self-regulatory, and social development (Tronick, 1995).

In sum, this study examined the effects of early mother–infant bodily contact on the development of mother–infant, father–infant, and family interaction patterns. Four sets of hypotheses were proposed. First, we expected that KC would positively affect the mother–infant relationship, in terms of increased maternal sensitivity and lower maternal intrusiveness. Second, on the basis of the systems approach, similar gains were expected in the father–infant relationship and in the family process, as manifested in increased paternal sensitivity and decreased paternal intrusiveness during father–infant interactions and in increased family cohesiveness and decreased family intrusiveness during triadic interactions. Third, on the basis of the observation that mother–infant bodily contact increases affiliative behavior and touch in animal models (Insel, 1997), more parent–infant affectionate touch was expected in the KC group. However, consistent with the proposed relations between the marital and parenting systems (Cowan & Cowan, 1992), the increase in parent–infant touch was expected to appear hand-in-hand with an increase in touch between spouses. The final set of hypotheses considered the KC method as a model for assessing change in family systems. In line with research on co-parenting, associations were expected between maternal and paternal global relational style (e.g., sensitivity, intrusiveness) as well as micro-level patterns during triadic interactions. This assumption followed the suggestion that co-parenting may be observed during independent parent–child interactions and in triadic interactions (Belsky, 1981). In light of Parke and Tinsley's (1987) proposition, links were expected between micro-level processes and global relational styles. Finally, in predicting the higher order process, the behaviors of both individuals and dyads, observed on global and micro-analytic levels, were expected to have independent contributions to predicting variability in family cohesion and intrusiveness.

Method

Participants

The sample included 146 premature infants whose mean birth weight was 1,270 g (2.79 lb.), with *SD* = 343.49 (0.75 lb.) and range = 530–1,720 g (1.16–3.79 lb.), and whose mean gestational age was 30.65 weeks (*SD* = 2.76, range = 24–34 weeks). Of these, 73 infants underwent kangaroo care (KC) and 73 served as controls. Infants in the two groups were matched for birth weight, gestational age, gender, and medical risk. Infants were excluded from the study if they had intraventricular hemorrhage (IVH) Grades III or IV or suffered from perinatal asphyxia or metabolic or genetic disease. In the two groups, each mother was married to the infant's father, mothers were at least 20 years old, parents had completed high school, and families' socioeconomic status was considered middle class by Israeli standards (Harlap, Davis, Grower, & Prywes, 1977). Families were matched for parity (first vs. later born), maternal employment (no vs. part-time vs. full-time employment), and ethnicity. Twins and singletons, equally numbered in the two groups, were matched separately for birth weight, gestational age, and medical risk. Family and infant information appears in Table 1.

Recruitment

As KC is a standardized care option in some hospitals in Israel and is not considered an experimental technique, prospective randomization of KC and controls was precluded for ethical reasons.

Table 1
Family Demographic and Infant Medical Variables

Characteristic	Kangaroo care		Control	
	M	*SD*	*M*	*SD*
Birthweight in grams (pounds)	1,245.85 (2.74 lb)	328.21 (0.72 lb)	1,289.87 (2.84 lb)	358.08 (0.78 lb)
Gestational age (weeks)	30.38	2.50	30.82	2.98
CRIB (medical risk score)	2.29	2.98	2.25	2.96
Mother age (years)	29.63	4.72	29.07	6.14
Mother education (years)	14.70	1.94	14.11	2.32
Father age (years)	32.29	5.89	32.46	7.75
Father education (years)	14.47	2.27	14.55	3.78
Male–female ratio	37:36		38:35	
Firstborn–later born ratio	36:37		36:37	

Note. CRIB = Clinical Risk Index for Babies.

Comparison was therefore performed between matched infants born in two separate hospitals who were cared for concurrently. This method of recruitment minimized the selection bias that would have occurred if the comparison had been between infants cared for in the same hospital whose mothers chose KC and those who did not. The nurseries in the two hospitals are Level 3 referral centers with a comparable number of admissions, case mix, patient care routines (excluding KC), and nurse–patient ratios. In both units, parents had unlimited privileges and were encouraged to take active part in their infant's care. Mothers delivered in respective hospitals according to the geographical area of their home residence. There was no selection by parents of the study birth hospital based on knowledge of infant care practices. The study was designed for a period when the two hospitals were implementing KC and capitalized on the fact that one hospital initiated KC shortly before the other. Thus, selection bias and known hospital confounders were kept at a minimum.

Seventy-three control infants and mothers who did not have KC were enrolled from Shaare-Zedek Medical Center, Jerusalem (A), and 53 infants and mothers who participated in KC were enrolled from the Schneider Children's Hospital in the greater Tel-Aviv area (B). Subsequently, after KC was instituted in Hospital A, an additional 20 infants were enrolled from Hospital A in the KC group. There were no differences in birth weight, gestational age, and family demographics in the two subgroups of KC infants from the two hospitals.

Procedure

Families whose infants matched the study criteria were approached several days to several weeks (depending on infant age and medical condition) after birth for enrollment in the study. All mothers in the neonatal intensive care unit whose family and infant conditions met the study criteria were approached. Ultra-orthodox Jews and Arabs were not approached, as their participation required the permission of religious authorities, they comprise a small section of the population, and large national representative studies have similarly decided not to include these groups (e.g., Sagi, Koren-Karie, Gini, Ziv, and Joels, 2002). Eight mothers who were approached to participate in the KC group declined, though four of those continued to provide KC. Six mothers who were approached to participate as controls declined, citing time constraints as the main reason. These mothers and infants did not differ from the participating families on any demographic or infant measures. The high participation rate in the study (89%) followed a training program for the nursing staff on the importance and implementation of the KC method. In addition, in each hospital a special nurse was appointed to implement KC who was enthusiastic about the method and personally involved in assisting each new mother in the KC procedure.

Infants were enrolled in the KC group when their medical situation stabilized, and they were no longer ventilated. Infants receiving supplementary oxygen by nasal catheter and/or intravenous fluids were enrolled in study. Mother–infant dyads were enrolled in the study if the following three conditions were met: (a) mothers agreed to perform KC for at least 14 consecutive days; (b) on these days, mothers agreed to perform KC for at least 1 hr daily; and (c) infants were not expected to transfer from enclosed incubators to open incubators during that 2-week period. Thus, the KC intervention targeted a period when the premature infant was otherwise deprived of full maternal contact. Mothers were trained by the nursing staff to perform KC. Infants were taken out of the incubator, undressed (wearing only a diaper and sometimes a cap), and placed between the mother's breasts. During KC, infants remained attached to a cardio-respiratory monitor and were observed by the nursing team who recorded the exact time of KC and when the infant returned to incubator care. During the study period, mothers provided on average 26.62 hr of KC ($SD = 12.14$).

Infants were initially observed before KC began (controls at 32 weeks gestation, matched to the mean age of initiation of KC), at 37 weeks gestation prior to discharge from the hospital, at 3 months corrected age at home, and at 6 months corrected age in the laboratory. The 3-month visit began with introducing various stimuli to the infant. Next, mothers and fathers were videotaped in parent–child interactions. Parents sat next to the infant, often in the family's living room with the infant in an infant seat and were asked to play freely with the infant. Five minutes of each mother–infant and father–infant interaction were videotaped (counterbalanced). Following the two parent–infant interactions, 5 min of triadic mother–father–infant interaction was videotaped. Parents were asked to engage in play among the three of them, but no instructions on how to position the infant were given. Often (a) parents positioned the infant on a sofa or carpet with both parents looking at the child, (b) parents placed the infant in an infant seat with one parent on either side, or (c) one parent held the infant while the other looked at the infant. Twins were seen separately with mother, father, and the triad. Following the videotaping, trained assistants observed the home for 1.5 hr and evaluated the home environment through observations and questions using the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1978). Last, parents completed self-report measures. Twelve families missed the 3-month session, and for 14 more families the father was not present. These families did not differ from the remaining families on any parent or infant variables, including group assignment.

Measures

Infant Medical Risk

The Clinical Risk Index for Babies (CRIB; International Neonatal Network, 1993) was used in the present study as an objective quantitative measure of neonatal medical risk for infants born prematurely. The CRIB is scored on the basis of the following items: birth weight, gestational age, minimum and maximum fraction of inspired oxygen, minimum base excess during the first 12 hr, and the presence of congenital malformations. Scores are summed to create the total CRIB score. The CRIB was calculated by the medical staff and was used as the basis for group assignment.

Parenting Stress

The short form of the Parenting Stress Index (PSI; Abidin, 1983) is a 36-item questionnaire that measures the relative magnitude of stress in the parent–child system. The PSI has been extensively used to assess stress and parenting behavior and is reported to have high internal consistency and good test–retest reliability (Abidin, 1983).

Parental Competence and Satisfaction

The Parental Competence and Satisfaction Scale (PCSC; Johnston & Mash, 1989) is a 17-item instrument assessing the level of parental anxiety, frustration, motivation, competence, and problem solving. Two factors are extracted: Competence and Satisfaction, and the instrument has shown good reliability and validity.

Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1978)

The HOME, which evaluates the quality of the child's home environment, was administered in the home with both parents and child present. The HOME includes 55 items and information noted during a 1.5-hr observation period in addition to direct questions of the parents. Six composites are computed, and a total score is calculated by summing these composites. Research assistants, unaware of infant group assignment, were trained to 95% reliability and observed and questioned mother and father separately. Separate scores were calculated for mothers and fathers on Composites 1, 2, and 5 and on the total HOME score. To examine links between the videotaped interactions and the child's general experience in the home context, the present study uses mothers' and fathers' total HOME scores along with the first composite, Emotional and Verbal Responsiveness, which measures parental sensitivity.

Videotaped Coding

The videotapes were coded in two stages. First, global codes assessed dyadic and triadic interactions, and second, microanalytic patterns of family proximity and touch were examined.

Global Codes of Dyadic and Triadic Interactions

Global dyadic interactions. Mother–infant and father–infant interactions were each coded according to the Coding Interactive Behavior Manual (CIB; Feldman, 1998). The CIB is a global rating system that includes 42 codes: 21 for parents, 16 for infants, and 5 for dyads, each rated on a 5-point scale ranging from 1 (*low*) to 5 (*high*). Codes are averaged into six composites. The CIB has been validated in studies of healthy and at-risk dyads and has shown sensitivity to infant age and cultural setting and to biological and emotional risk (Feldman, 2000; Feldman, Greenbaum, Mayes, & Erlich, 1997; Feldman et al., 2001; Keren, Feldman, & Tyano, 2001). Composites, codes, and internal consistency for this sample were as follows:

1. *Parent Sensitivity and Responsiveness* (mother α = .90; father α = .91): Codes include parent acknowledgement of infant's signals, maintenance of visual contact, warm and positive affect, appropriate vocal quality, resourcefulness in handling infant distress or in expanding the interaction, consistency of style, and adaptation to the infant's changing states.
2. *Parent Intrusiveness* (mother α = .77; father α = .81): Codes include parent's physical manipulation of infant's body, interruption of infant's activities, breaking gaze while infant is looking, disregard of infant's signals, and parent leading the interactions.
3. *Infant Positive Affect* (mother α = .78; father α = .75): Codes include infant maintaining alert state, showing positive arousal, and expressing positive affect and contentment.
4. *Infant Negative Emotionality* (mother α = .71; father α = .76): Codes include infant showing fatigue and tiredness, emitting fuss-cry vocalization, withdrawing, showing discontentment.
5. *Infant Initiation and Involvement* (mother α = .75; father α = .71): Codes include infant initiating interactive bids, infant vocalization, and interaction judged to be infant-led.
6. *Dyadic Reciprocity* (mother α = .89; father α = .87): Codes include interactions characterized by give-and-take play; synchronous interaction; and rhythmic, fluent dyadic style.

Coding was conducted by two coders, blind to the infants' group membership, who were trained to 90% agreement on all categories. Interrater reliability averaged 93%; κ = .80. To avoid rater bias, coding of the two parent–infant interactions was not done successively.

Global Triadic Interactions. Consistent with the family perspective, global coding was conducted for the family as a single functional unit (i.e., triad), along 15 codes. Each code was rated globally on a scale from 1 (*low*) to 5 (*high*), addressing the degree to which it described the family's relational style during the triadic interaction. Twelve codes described pairs of opposite family styles, and each opposite was coded separately on a scale ranging from 1 to 5. These opposite pairs included avoidance–involvement, autonomy–intrusiveness, activity–passivity, cooperation–competition, creative play–didactic play, and parent-oriented interaction–infant-oriented interaction. In addition, 3 codes addressed the global atmosphere: level of affect, mutual gaze, and use of toys. Coders, blind to group membership, were trained to 90% reliability, and interrater reliability averaged 92%, κ = .78.

A principal-components factor analysis of the 15 family codes yielded two factors with eigenvalues of 2.00 and above. The first factor explained 34% of the variance, had an eigenvalue of 5.72, and included: positive affect, mutual gaze, cooperation, avoidance (negative), creativity, and autonomy. These codes were averaged into a Family Cohesiveness composite (Cronbach's alpha = .82), which was used as an index of the family's cohesive and harmonious style. The second factor explained 15% of the variance, had an eigenvalue of 2.62, and included intrusiveness, competition, parent-directed interaction, and didactic play. These codes were averaged into a Family Intrusiveness composite (Cronbach's alpha = .77), which was used as an index of the family's intrusive and competitive style. Similar factors emerged in a sample of healthy infants and their parents (Feldman et al., 2001), validating the present findings.

Microanalytic Patterns of Triadic Interactions: Gaze, Affect, Proximity, and Touch

To provide a full matrix for touch patterns among three people, we coded the behavior of each family member individually (mother, father, and infant) and bidirectionally between each dyad (mother–infant, infant–mother, father–infant, infant–father, mother–father, father–mother) separately. For this analysis, the 5-min videotaped triadic interactions were coded for four categories: gaze, affect, proximity, and touch. Coding was conducted by a team of two coders, using a continuous mode on a computerized video analysis system (The Observer, Noldus, Wageningen, the Netherlands) while the tape was running in slow motion. Coding was conducted for one family member or dyad per viewing, and approximately 3 to 4 viewings were required to code each family member or dyad. Codes within each category were mutually exclusive. Reliability was computed on 15 triadic interactions, and reliability in all categories exceeded 87%. Reliability averaged 92%, κ = .79. Categories and codes in each category were as follows:

Gaze. *Mother gaze* and *father gaze* included gaze to infant, to partner, or to object or unfocused gaze. *Infant gaze* included gaze to mother, to father, or to object or unfocused gaze.

Affect. *Mother affect, father affect,* and *infant affect* included high positive (laughs, shows clear signs of joy and exuberance), medium-level (maintains alertness, neutral facial expression, no signs of joy), low (wary, withdrawn), or negative (fusses, cries, shouts).

Proximity. *Mother proximity to infant* and *father proximity to infant* included infant in parent's arms, infant within parent's arms' reach, or infant far (not within arms' reach). *Infant proximity to*

mother and *infant proximity to father* included infant in parent's arms, infant on parent's lap, infant in infant seat, or infant free (e.g., on a sofa or carpet). *Mother proximity to spouse* and *father proximity to spouse* included touching spouse (a portion of body was in contact, e.g., mother leaning on father), spouse within arms' reach, or spouse far.

Touch. Mother touching infant and *father touching infant* included: no touch, accidental touch, functional touch (wipes the baby's mouth), proprioceptive touch (changes the infant's position in space by throwing the infant in the air or pulling up to a sitting position), touch with object (parent holds toy and intentionally touches infant), or affectionate touch (hugs, kisses, caresses, tickles, lovingly pokes). *Mother touching spouse* and *father touching spouse* included no touch, accidental touch, functional touch (e.g., hands infant to spouse), and affectionate touch. *Infant touching father* and *infant touching mother* included no touch, accidental touch (infant's hand drops, thereby brushing parent's hand), or touch (longer or more intentional, may be accompanied by change in facial expression and gaze).

Results

Results are reported in four sections, along the study's hypotheses. First, we explored differences between KC and controls on interactive patterns during mother–infant interaction (Hypothesis 1). Second, we examined KC effects on father–infant and triadic interactions (Hypothesis 2). Third, an in-depth analysis of micro-level family patterns is presented (Hypothesis 3). Finally, KC is examined as a model for testing change in family systems (Hypothesis 4). This section examined (a) relations between maternal and paternal dyadic behaviors, (b) associations between maternal and paternal micro-patterns in triadic sessions, and (c) the prediction of family cohesiveness and intrusiveness by individual, dyadic, and triadic patterns. Prior to data analyses child gender and multiple-birth status (twins vs. singletons) effects were explored for all interactive variables but not found and were thus omitted from subsequent analyses. Previous research pointed to links between birth order, mothering, and prematurity (e.g., Cohen & Beckwith, 1977), and thus birth order (firstborn vs. later born) was entered as an additional between-subjects variable in all analyses.

KC and Mother–Infant Interaction

A multivariate analysis of variance (MANOVA) with group (KC vs. control) and birth order as the between-subjects factors was computed for the six global interaction composites during mother–infant interaction. A significant overall effect was found for group; Wilks's $F(6, 125) = 8.21$, $p < .01$. Univariate tests (Table 2) show that following KC, mothers were more sensitive and less intrusive during interaction, the level of dyadic reciprocity was higher, and infants showed less negative emotionality during social play.

A significant overall effect was also found for birth order, Wilks's $F(6, 125) = 2.58$, $p < .05$. Univariate tests revealed differences in infant initiation, $F(1, 125) = 6.13$, $p < .05$, and in infant positive affect, $F(1, 125) = 14.27$, $p < .01$. Firstborn infants showed a lower level of initiation ($M = 1.86$, $SD = 0.64$) as compared with later born infants ($M = 2.13$, $SD = 0.74$), and firstborn infants exhibited less positive affect ($M = 3.55$, $SD = 0.73$) as compared with later-born infants ($M = 3.83$, $SD = 0.66$) during play. Finally, a significant overall interaction effect was found, Wilks's $F(6, 125) = 3.64$, $p < .01$. Univariate analysis revealed a significant interaction effect for infant positive affect, $F(1, 125) = 12.23$, $p < .01$, and for dyadic reciprocity, $F(1, 125) = 16.19$, $p < .01$. Post hoc comparisons

Table 2
Univariate Analysis: Global Patterns of Parent–Infant and Triadic Interactions

Variable	Kangaroo care		Control		Univariate F[a]
	M	*SD*	*M*	*SD*	
Mother–infant interactions					
Parent sensitivity	4.14	0.59	3.78	0.80	10.43**
Parent intrusiveness	2.02	1.00	2.53	0.91	6.89**
Infant positive affect	3.70	0.63	3.73	0.77	*ns*
Infant negative emotionality	1.38	0.65	1.51	0.70	7.55**
Infant initiation and involvement	1.94	0.62	2.05	0.72	*ns*
Dyadic reciprocity	3.71	1.02	3.24	1.10	10.17**
Father–infant interactions					
Parent sensitivity	4.19	0.58	3.76	0.78	11.10**
Parent intrusiveness	2.02	0.98	2.74	0.89	15.84**
Infant positive affect	3.74	0.78	3.65	0.79	*ns*
Infant negative emotionality	1.27	0.81	1.56	0.86	4.13*
Infant initiation and involvement	1.97	0.80	2.11	0.57	*ns*
Dyadic reciprocity	3.56	1.02	3.06	1.17	6.34**
Family interactive style					
Family cohesiveness	3.71	0.59	3.44	0.57	10.33**
Family intrusiveness	1.61	0.59	2.09	0.64	8.41**

[a] Univariate F measured group differences between kangaroo care and controls; degrees of freedom were (1, 125), (1, 111), and (1, 115), for mother–infant interaction, father–infant interaction, and family interactive style, respectively.
* $p < .05$. ** $p < .01$.

showed that for the controls, reciprocity was lower between mothers and firstborn infants (for firstborns, $M = 2.85$, $SD = 1.20$; for later borns, $M = 3.42$, $SD = 1.02$), $F(1, 62) = 3.99$, $p < .05$, but no differences were found for the KC group (for firstborns, $M = 3.89$, $SD = 0.86$; for later borns, $M = 3.54$, $SD = 0.87$). Similarly, later born controls exhibited significantly more positive affect than firstborns (for firstborns, $M = 3.23$, $SD = 0.88$; for later borns, $M = 3.96$, $SD = 0.61$), $F(1, 62) = 14.69$, $p < .01$, but no differences were found in the KC group (for firstborns, $M = 3.77$, $SD = 0.57$; for later borns, $M = 3.64$, $SD = 0.96$).

To examine whether the effects of KC on maternal behavior are explained by the reduction in infants' negative emotionality, we computed a multivariate analysis of covariance (MANCOVA) with maternal sensitivity and intrusiveness as the dependent variables, KC as the between-subjects variable, and infant negative emotionality as the covariate. An overall effect was found for group, Wilks's $F(2, 129) = 14.07$, $p < .01$, with univariate effects for both sensitivity and intrusiveness. These data indicate that the effect of KC on mothering is independent of its effect on infant state.

KC and Father–Infant and Triadic Interactions

Father–Infant Interaction

We computed a multivariate analysis of variance (MANOVA) with group (KC vs. control) and birth order as the between-subjects variables for the six father–infant interactive composites. A significant overall effect was found for group, Wilks's $F(6, 111) = 7.79$, $p < .01$. Univariate tests (Table 2) revealed that KC fathers were more sensitive and less intrusive, reciprocity was higher, and infants showed less negative emotionality. No birth order effects were found.

Triadic Family Patterns

We computed a MANOVA with group and birth order as the between-subject variables for the two family composites: cohesiveness and intrusiveness. A significant overall effect was found for group, Wilks's $F(2, 115) = 10.21$, $p < .01$. Univariate tests (Table 2) revealed higher cohesiveness and lower intrusiveness in the KC group. An overall effect was found for birth order, Wilks's $F(2, 115) = 5.57$, $p < .01$. Families with firstborns showed lower cohesiveness ($M = 3.36$, $SD = 0.58$) as compared with parents and their later born infants ($M = 3.74$, $SD = 0.57$). The data presented in this section demonstrate that mother–infant kangaroo contact positively impacts father–infant interactions and the family relations.

Finally, to examine whether the codes derived from the parent–child and triadic sessions are related to the infant's general experience within the home context, correlations between the parents' HOME (Caldwell & Bradley, 1978) scores with maternal, paternal, and family sensitivity and intrusiveness were computed. Mothers' total HOME score was related to maternal sensitivity ($r = .23$, $p < .05$). The mother's verbal and emotional responsiveness score was similarly related to maternal sensitivity ($r = .30$, $p < .001$). Fathers' total HOME was related to paternal sensitivity ($r = .46$, $p < .001$) as well as fathers' emotional and verbal responsiveness, ($r = .46$, $p < .001$). Mothers' and fathers' total HOME scores were related to family cohesiveness ($rs = .33$ and $.36$, $p < .001$ for mothers and fathers respectively). The HOME measures were not related to parental or family intrusiveness. These data provide some support to the hypothesis that the measures of sensitivity, derived from a relatively brief interaction, capture an aspect of the child's rearing environment and experiences with the parent, as assessed by a standard multi-measure instrument (i.e., observations in several settings, parental questions).

Micro-Level Family Processes

For a fuller understanding of the micro-regulatory triadic patterns, three topics are explored in this section. These include (a) differences between mothers' and fathers' behavior in the triadic setting; (b) the conditions under which affectionate touch tended to occur, and (c) KC effects on the co-regulatory patterns of gaze, affect, proximity, and touch.

Mother–Father Differences

For *gaze*, during triadic interactions, infants tended to look more at mothers than at fathers, $t(1, 119) = 2.70$, $p < .01$. No difference was found between mothers' and fathers' gaze at the infant or between mothers' and fathers' gaze at the spouse. For *affect*, during triadic interactions, mothers maintained more neutral affect than fathers, $t(1, 119) = 2.36$, $p < .05$, and fathers showed higher levels of positive affect, $t(1, 119) = 1.96$, $p < .05$. For *proximity*, no differences were found between mothers' and fathers' spatial position in relation to their infants (infant in arms, within arms' reach, or far). For *touch*, no differences were found between mothers and fathers in their overall amount of touching of the infant or in any specific type of touch. With regard to spousal touch, mothers exhibited more episodes of functional touch toward fathers than vice versa, $t(1, 119) = 1.99$, $p < .05$, and fathers evidenced more "no touch" of their wives than vice versa, $t(1, 119) = 1.87$, $p < .05$. No differences were found between the infant's touch of mother versus father.

Conditions of Parent and Infant Affectionate Touch

As little research has focused on touch, next we examined the conditions under which touch tended to occur. A series of conditional probabilities were computed, and differences were examined between each pair using a paired-sample t test (e.g., proportion of parent's affectionate touch while parent gazed at infant versus proportion of parent's affectionate touch while parent's gaze is unfocused).

Gaze and affectionate touch. Affectionate touch tended to occur during periods of mutual gaze between partners, pointing to the role of touch in the co-regulation of interaction. Differences between these two conditions (parent

touch while parent looking at infant versus parent touch while parent is in unfocused gaze) were significant, $t(1, 119) = 9.37$, $p < .01$, and $t(1, 119) = 9.76$, $p < .01$, for mothers and fathers respectively. Fathers' touch was also more likely to occur when the infant looked at the father as compared with times of infant unfocused gaze, $t(1, 119) = 4.15$, $p < .01$. Mothers tended to touch when the infant looked either at mother or at father, but less when the infant's gaze was unfocused, $t(1, 119) = 4.26$, $p < .01$.

Affect and affectionate touch. Mothers tended to provide affectionate touch when they were in neutral affect as compared with other affective states, $t(1, 119) = 6.12$, $p < .01$. Fathers provided more touch when in positive affect, $t(1, 119) = 3.71$, $p < .01$.

Proximity and affectionate touch. Mothers were most likely to touch the infant when he or she was in a "free" position (on couch, carpet, etc.) and least likely to touch when the infant was in an infant seat, $t(1, 119) = 2.48$, $p < .05$. Fathers touched the infant most when he or she was in the fathers' arms or in a free position and least when the infant was in an infant seat, $t(1, 119) = 3.03$, $p < .01$, for arms vs. infant seat, and $t(1, 119) = 2.97$, $p < .01$, for free vs. infant seat, respectively. Infants were more likely to touch the parent when they were in the free position and least likely when they were in the infant seat, $t(1, 119) = 3.13$, $p < .01$, for mother and $t(1, 119) = 2.22$, $p < .05$, for father. Thus, touch typically occurs during periods of shared visual attention, when the infant is in a position free of physical constraints (in seat, arms).

KC and Micro-Level Family Patterns

For *gaze*, a MANOVA with group and birth order as the between-subjects variables computed for mother gaze and father gaze variables showed no overall effects. However, a similar MANOVA computed for infant gaze showed an overall effect for group, Wilks's $F(4, 113) = 2.83$, $p < .05$. Univariate tests, reported in Table 3, showed that KC infants spent less time in unfocused gaze as compared with controls. For *affect*, no overall or interaction effects were found for mother, father, or infant affect. For *proximity*, a MANOVA with group and birth order as the between-subjects variables, computed for the infant proximity position in relation to the parent (free, infant seat, arms, lap), revealed an overall effect for group, Wilks's $F(4, 113) = 5.71$, $p < .01$. Univariate tests, reported in Table 3, showed significant differences between groups in the free, lap, and infant seat proximity positions. KC infants were often

Table 3
Univariate Analysis of Microanalytic Triadic Family Patterns

Variable	Kangaroo care		Control		Univariate
	M	*SD*	*M*	*SD*	*F*(1, 113)
Infant gaze					
To mother	.22	.21	.15	.13	*ns*
To father	.16	.17	.11	.13	*ns*
To object	.07	.17	.03	.12	3.08*
Unfocused	.55	.21	.71	.33	8.05**
Proximity (parent–infant and spousal)					
Parent–infant					
Infant in parent's lap	.41	.38	.37	.36	*ns*
Infant in parent's arms	.16	.25	.32	.28	6.05**
Infant in infant seat	.10	.28	.20	.39	4.41*
Infant in "free" position	.33	.44	.11	.25	7.17**
Spousal					
Mother and father in physical touch	.31	.45	.16	.34	3.76*
Mother and father within arms' reach	.62	.38	.70	.45	*ns*
Mother and father out of reach	.07	.20	.13	.31	4.68*
Touch (mother–infant, father–infant, mother–father)					
Mother–Infant					
Loving	.22	.17	.13	.14	3.82*
With object	.04	.07	.02	.04	*ns*
Proprioceptive	.03	.04	.02	.04	*ns*
Unintentional	.01	.02	.01	.04	*ns*
Father–infant					
Loving	.21	.17	.13	.13	3.75*
With object	.04	.07	.02	.06	*ns*
Proprioceptive	.03	.01	.01	.04	2.91*
Unintentional	.00	.05	.00	.04	*ns*
Mother–Father					
Loving	.07	.04	.02	.04	3.63*
Functional	.03	.01	.07	.03	2.53*
Unintentional	.03	.03	.04	.03	*ns*

Note. Decimal values represent proportion of time spent in each state.
* $p < .05$. ** $p < .01$.

placed in a "free" position, whereas controls were often placed in more constrained positions: on one parent's lap or in the infant seat. A similar MANOVA conducted for the mother's proximity to father (touching, within arms' reach, far) revealed a significant overall effect for group, Wilks's $F(3, 114) = 3.14$, $p < .05$. Univariate analysis (Table 3) showed that KC parents touched each other more and spent less time out of each other's arms' reach, as compared with parents of controls.

For *touch*, a MANOVA with group and birth order as the between-subjects variables, computed for the infant touch variables, showed no overall effect. A similar MANOVA computed for mother touch of infant revealed an overall effect for group; Wilks's $F(6, 111) = 2.93$, $p < .05$. Univariate tests (Table 3) revealed a significant KC effect for maternal affectionate touch. A MANOVA for father touch of infant revealed an overall effect for group, Wilks's $F(6, 111) = 2.89$, $p < .05$, and univariate tests (Table 3) showed differences in father affectionate touch. Thus, both mothers and fathers of KC infants provided more affectionate touch in triadic play. An analysis of covariance with parent affectionate touch as the dependent measure, group as the between-subjects variable, and free position as the covariate, showed group differences for both mothers, $F(1, 118) = 2.91$, $p < .05$, and fathers, $F(1, 118) = 2.86$, $p < .05$, suggesting that these differences are not an artifact of proximity position.

With regard to touch between spouses, no overall effects were found for fathers' touching their wives. However, following KC, mothers touched their husbands more frequently. A MANOVA with group and birth order as the between-subjects variable for the wife touching husband variable revealed an overall effect for group, Wilks's $F(4, 113) = 2.89$, $p < .05$. Univariate tests, presented in Table 3, showed that mothers who provided kangaroo contact showed more affectionate touch to their spouses as compared with mothers in the control group.

Finally, univariate analysis of variance computed for the latency (in seconds) prior to the first affectionate touch during the triadic interaction revealed a main effect for group, $F(1, 119) = 6.28$, $p < .01$. Following KC, mothers touched their infants significantly more quickly ($M = 32.6$ s) as compared with control mothers ($M = 69.9$ s). In sum, the findings indicate positive effects of KC on triadic micro-patterns. KC infants were more attentive during triadic play. KC parents placed the infants in the "free" position, which is conducive to mutual gaze and touch. More physical proximity and loving maternal touch of father was found in the KC families, and both parents provided more affectionate touch to their infants.

Change in Family Systems: Predicting the Family's Cohesive and Intrusive Style

Three topics were examined in this section: (a) associations between maternal and paternal dyadic behavior, (b) associations between touch patterns in the family subsystems, and (c) predicting the family's style by individual, dyadic, and triadic factors.

Associations Between Mother–Infant and Father–Infant Interactions

Significant correlations were found between mothers' and fathers' behavior on all interactive composites. Correlations were $r = .38$ ($p < .01$) for parental sensitivity; $r = .65$ ($p < .01$) for intrusiveness, $r = .36$ ($p < .01$) for reciprocity, $r = .47$ ($p < .01$) for infant initiation, $r = .40$ ($p < .01$) for infant positive affect, and $r = .42$ ($p < .01$) for negative emotionality. To examine whether relations between parental behaviors are independent of infant state, we computed partial correlations, controlling for infant negative emotionality. Significant correlations were found for parental sensitivity ($r = .38$, $p < .01$), intrusiveness ($r = .55$, $p < .01$), and reciprocity ($r = .37$; $p < .01$).

Associations Between Touch Patterns in the Three Dyadic Subsystems

Mothers' and fathers' affectionate touch of spouse was interrelated ($r = .40$, $p < .01$). Wife's affectionate touch of husband was unrelated to maternal touch of infant but was significantly correlated with father's affectionate touch of infant ($r = .28$, $p < .01$). Similarly, husband's affectionate touch of wife was unrelated to paternal touch of infant but was significantly associated with mother's affectionate touch of infant ($r = .21$, $p < .05$).

Predicting the Cohesive and Intrusive Family Style

We computed two hierarchical regression models predicting family cohesion and intrusiveness. Variables were entered in six blocks in a predetermined order. In the first block, infant medical risk, birth order, and the provision of KC were entered as the neonatal measures. Next, variables were entered in sequence from the microanalytic to the global measures and from observed behavior to self reports. In the second block, touch within the three dyadic systems was entered. In the third, the infant's micro-measures were entered: the free proximity position and unfocused gaze. In the fourth block, maternal and paternal sensitivity during dyadic interactions were entered as predictors of family cohesiveness, and maternal and paternal intrusiveness in the dyad were entered as predictors of the family's intrusive style. In the fifth block, parenting stress was indexed by maternal and paternal PSI, as stress is related to lower family harmony. The mother's competence and satisfaction were entered last as indices of the mother's sense of the parenting role. Results predicting family cohesiveness are presented in Table 4.

As seen in Table 4, the family's more cohesive style was predicted by experiencing kangaroo contact in the neonatal period, the infant's position in the family (later born infants), more affectionate touch within each dyadic subsystem, the mother's higher global sensitivity during mother–infant interaction, and the mother's greater sense of satisfaction in the parental role. In combination, these factors accounted for 49% of the variance in family cohesiveness.

Table 4
Predicting Family Cohesiveness

Predictors	β	Multiple R	R^2_{change}	F_{change}	df
Step 1					
Medical risk	−.03				
Birth order	.23*				
Kangaroo care	.18*	.38	.15	2.87*	3, 115
Step 2					
Mother loving touch	.18*				
Father loving touch	.17*				
Spousal loving touch	.21*	.53	.14	3.88**	6, 112
Step 3					
Infant proximity "free"	.09				
Infant unfocused gaze	−.07	.59	.03	1.56	8, 110
Step 4					
Mother sensitivity	.24*				
Father sensitivity	.16	.63	.09	4.99**	10, 108
Step 5					
Maternal parenting stress	−.08				
Paternal parenting stress	.00	.64	.00	0.44	12, 106
Step 6					
Maternal competence	.13				
Maternal satisfaction	.28**	.70	.08	5.04**	14, 104

Note. R^2 total = .49, $F(14, 104) = 4.36$, $p < .01$.
* $p < .05$. ** $p < .01$.

Results of the regression equation predicting family intrusiveness appear in Table 5. As seen in the table, the intrusive family style was predicted by kangaroo care, with controls scoring higher on intrusiveness and lower on parent–infant touch, showing more unfocused gaze, and exhibiting greater paternal intrusiveness during dyadic interactions. These variables explained 34% of the variance in family intrusiveness.

Finally, although families in the two groups were matched for a variety of parental and infant variables, the potential confounding effect of hospital site was further examined in a series of ANOVAs. These analyses assessed group differences between KC ($n = 20$) and controls ($n = 73$) from Hospital A on each of the main study outcomes.[1]

Discussion

This study's goal was to identify aspects of parent–infant and family relatedness that may be improved following the provision of mother–infant kangaroo contact in premature infants. In addition, the study used the KC intervention to assess how change in one relationship impacts the other components of the family system. Results suggest that following kangaroo contact early in life, later interactions between mothers and infants as well as between fathers and infants were characterized by higher sensitivity, lower intrusiveness, higher parent–infant reciprocity, and lower infant negative emotionality. Similarly, the family's later relational style was more cohesive and less intrusive. The study also showed links between individual, dyadic, and triadic family systems following intervention in infancy. Still, the fact that this was not a randomized clinical study but a comparison between two matched groups should be remembered in the interpretation of the findings.

KC and the Mother–Infant Relationship

The improvements in the mother–infant relationship among the KC group may have been influenced by several factors. Following premature birth, mothers experience higher depression, anxiety, and a lower sense of competence, while caretaking and touch are reduced, patterns that persist even several weeks after discharge (Davis & Thoman, 1988; Meyer et al., 1995; Singer et al., 1999). Studies of mother–infant interactions among premature infants in the first months of life point to a paradoxical pattern. Mothers often increase the level of talking, toy presentation, or physical manipulation, leading to higher intrusiveness, whereas these maternal behaviors are less adapted to the child's cues, leading to lower sensitivity. This maternal style had been viewed in terms of guilt and overcompensation, reduced familiarity with the infant, or missing a critical period for attachment (Feldman, Greenbaum, & Yirmiya, 1999; Greene, Fox, & Lewis, 1983; Minde, 2000; Minde et al., 1983, 1989). The kangaroo intervention possibly addresses all of these aspects; it affords full bodily contact at the initial sensitive period, a chance to gradually learn the infant's cues, and an active role in infant care that reduces depression and incompetence (Affonso et al., 1993). Results show that mothers' sensitivity increased and intrusiveness

[1] Results showed significant group differences ($p < .05$) for the following variables: mother sensitivity, mother intrusiveness, mother affectionate touch, father sensitivity, family cohesiveness, and infant free proximity. Marginally significant results ($p < .10$) emerged for father affectionate touch and infant unfocused gaze. The other variables, including touch of spouse, father intrusiveness, and family intrusiveness, showed means in the expected directions, but no significant effects were found.

Table 5
Predicting Family Intrusiveness

Predictors	β	Multiple R	R^2_{change}	F_{change}	df
Step 1					
Medical risk	−.08				
Birth order	.07				
Kangaroo care	−.19*	.36	.13	3.60*	3, 115
Step 2					
Mother loving touch	−.32*				
Father loving touch	−.25*				
Spousal loving touch	−.06	.43	.05	1.95†	6, 112
Step 3					
Infant proximity "free"	−.08				
Infant unfocused gaze	.27	.49	.06	2.76*	8, 110
Step 4					
Mother intrusiveness	.03				
Father intrusiveness	.29*	.55	.09	2.87*	10, 108
Step 5					
Maternal parenting stress	−.08				
Paternal parenting stress	.00	.55	.00	0.15	12, 106
Step 6					
Maternal competence	−.12				
Maternal satisfaction	−.16	.58	.03	1.64	14, 104

Note. R^2 total = .34, $F(14, 104) = 2.57$, $p < .01$.
† $p < .10$. * $p < .05$.

decreased, suggesting that following KC mothers were better able to adjust stimulation to the infant's social signals. In addition to its independent effects on mothering, KC improved the infant's negative emotionality. The gains in infant emotion regulation may have had additional impact on the mother's behavior, leading to higher dyadic reciprocity.

Main and interaction effects between birth order and prematurity on maternal behavior have been previously reported (Bendersky & Lewis, 1986; Cohen & Beckwith, 1977). The data suggest that KC had more of an impact on the mothering of first-time mothers, possibly as these mothers had not formed a parenting style prior to the premature birth, and the kangaroo contact may have thus been more effective in reducing their stress and sense of incompetence. Finally, the findings that parental and family sensitivity observed during the relatively short interaction correlated with parental sensitivity as measured in a longer naturalistic observation may provide some additional support to the coded measure of maternal sensitivity examined here.

The Father–Infant and the Family Relationship

The improvements in the father–infant and family relationships following mother–infant kangaroo contact were, as hypothesized, in the same domains as those observed for the target system: higher sensitivity and lower intrusiveness. In line with the systemic family perspective, the findings for the triadic interaction point to the links between the two parenting systems and the whole family process (McHale & Cowan, 1996). Results for the father–infant interaction may be explained in terms of the co-parenting process (e.g., Belsky et al., 1995). Associations were found between mothers' and fathers' behaviors on the parental measures (sensitivity and intrusiveness), infant measures (positive affect, negative emotionality, initiative), dyadic reciprocity, and micro-level touch patterns. It appears that even at 3 months of age, when infants begin to take an active part in the social world (Stern, 1985), the co-parenting process is already well in place, observed on both micro-analytic and global levels, during dyadic and triadic interactions.

Results pertaining to the father–infant relationship are consistent with research on the relations between marriage and fathering. Fathering is considered a more multidimensional experience than mothering and is more closely tied to the marital quality (Belsky & Pensky, 1988; Parke & Beitel, 1988). The findings provide several examples for the relations between marriage and fathering. In the triadic context, the wife's loving touch of her husband increased following KC, albeit the husbands did not touch their wives more. Yet, among these KC families, the amount of paternal touch of infant did increase. Although it is possible that father–infant touch increased as a result of co-parenting processes, such as imitation of a more competent spouse, it is possible that the wives' greater affectionate touch of their husbands, which created higher marital intimacy in a whole family context, elicited paternal touch of the infant. Another example is the finding that father–infant touch was more likely to occur when both father and infant were looking at one another. Maternal touch of infant, on the other hand, was as likely to occur when the infant looked at mother or at father, perhaps pointing to a maternal mode of enhancing the infant's attention to his or her father. Finally, the findings that the mother's loving touch of father correlated not with her own touch of the infant, but with the father's touch of the infant may suggest that marital intimacy promotes fathering. It is thus possible that KC, in addition to its direct impact on mothering, also freed the mother to be more relaxed with the development of the mother–infant relation-

ship, thus allowing more space for the development of the father–infant relationship.

Micro-Regulatory Patterns of Touch, Proximity, Gaze, and Affect

Touch is among the less researched components of the parent–infant relationship, and patterns of touch in the triad have rarely been investigated previously. Field (1996) pointed to the role of touch in forming the mother–infant attachment and in managing stress. Perhaps the uniqueness of touch as a co-regulatory agent is that moments of touch involve the dyadic system, whereas signals such as gaze or affect may be unilateral. Affectionate touch tended to occur during moments of shared visual attention, when the infant was in a free position. Such a form of active loving touch differs from the more passive full-body contact during periods when the infant is carried in the arms or sitting on the lap—periods when no active social exchange takes place—and may help the partners manage the degree of social intimacy. The role of touch in providing the basis for attachment (Kaitz, Lapidot, Bronner, & Eidelman, 1992), in guiding the child's orientation to different social partners (Vandell, 1980), and in the self-regulation of arousal (Tronick, 1995) has been proposed. The present findings point to an additional role of touch in linking the two parenting systems and the marital system into a whole-family process. Wright (1991) suggested that social maturation involves a shift from full physical contact in the first weeks of life to interactions that rely on visual, tactile, and affect synchrony emerging in the third month. Possibly, one difference between infants in the experiment and control groups related to the parents' readiness to move from positions that involve full body contact (arms, lap) to a position that allows for the entire range of face-to-face signals between separate individuals. This is consistent with findings by Brown, Pipp, Martz, and Waring (1993), who found that stressful moments increased mother–infant proximity, whereas free play created more physical distance. Similarly, early kangaroo contact may have reduced parental stress, allowing for the free position and the emergence of affect synchrony (Feldman et al., 1999).

The Family Process

As proposed by the family systems perspective, the whole-family process was related to the various influences among family subsystems. Family cohesiveness was predicted by the amount of affectionate touch in each dyadic subsystem: mother–infant, father–infant, and marital, whereas family intrusiveness was related to reduced parent–infant affectionate touch. These data may point to the role of touch in defining the family's style as harmonious and sensitive or as competitive and hostile. The family style was also predicted by the parallel dyadic style: Parent sensitivity predicted family cohesiveness, and parent intrusiveness predicted family intrusiveness, pointing to the links between the dyadic and triadic systems. Of interest, the cohesive style was predicted by maternal, not paternal, sensitivity, whereas the intrusive family style was related to paternal, but not maternal, intrusiveness during dyadic interactions. Perhaps the mother's sensitivity is more crucial in defining the harmonious family atmosphere, inasmuch as the father's controlling style is more dominant in setting the family's atmosphere as competitive and hostile. Mother's satisfaction in the parental role was uniquely related to family cohesiveness, emphasizing the role of maternal representations to family life, particularly among high-risk premature infants (Corter & Minde, 1987). Malphurs, Raag, Field, Pickens, and Palaez-Nogueras (1996) pointed to the relations between maternal intrusiveness, depression, and a decrease in maternal positive touch, and the present findings show similar associations in a triadic context. Family intrusiveness was also related to infant unfocused gaze, pointing to the link between the intrusive style and infants' difficulties in regulating social attention. In line with family systems thinking, factors related to both microprocesses and global styles, observed during triadic and dyadic sessions and addressing both parent and infant behavior, had independent contributions to the prediction of the higher order family process. Family-level processes are multidimensional experiences that have multiple correlates, and much further research is required to achieve an in-depth understanding of family processes in infancy.

Finally, the limitations of this study primarily relate to the fact that this was not a prospective randomized study of control infants and those who received kangaroo contact. As noted, KC is not an experimental technique but is considered to be a standard care option, and thus randomization was precluded for ethical reasons. The fact that the hospitals introduced the KC methods at different periods provided an opportunity to compare control-matched mother–infant dyads from two hospitals who were being treated concurrently by otherwise similar clinical protocols, thus resolving the issue of bias of historical controls. Similarly, selection bias that would have ensued from comparing infants from mothers who received KC as opposed to those who refused to provide such care was minimized. The final analyses, which showed differences between KC and controls from the same hospital for most findings, further suggest that the effects of KC are probably independent of the hospital site.

Future research should address the long-term implications of the KC method in several domains. Skin-to-skin contact in the first weeks of life seemed to have an impact on dyadic and triadic family patterns when assessed more than 3 months later. It is of interest to study the further implications of these benefits on the infant, regarding social and cognitive development, as well as on the parental unit. Such research is important from clinical and theoretical standpoints, allowing the planning of innovative approaches to improving the family relationships. In addition, it is important to study whether KC provided by fathers or by trained personnel would have a similar impact on the parent–child or the family relationship.

Implications for Application and Social Policy

Results of this study suggest that the KC intervention contributes to the development of parent–infant relationship in premature infants and thus several directions for the implication of the findings may be considered. KC is an easy, cost-effective method that appears to have no negative side effects. To date, no large-scale longitudinal study has examined the relations between the KC intervention and the development of parent–infant and family relationships. The present results may suggest to professionals who are handling the premature infant and his or her parents that KC is not only a harmless intervention but may have a positive contribution to the social–emotional development of premature infants.

With regard to policy, unfortunately, KC is not yet offered as a standard practice in all Western neonatal intensive care units, as it requires more work and attention from the nursing staff. The findings may help make a case for the introduction of the KC method in neonatal intensive care units, to inform parents of this cost-free option for improving the attachment with their premature infants, and to provide training and guidance on how to maintain skin-to-skin contact. The provision of kangaroo contact, by mothers, fathers, grandparents, trained personnel, or volunteers, may not only promote the child's well-being but also sensitize the medical community to the social–emotional needs of the high-risk premature infant and his or her parents.

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Received July 13, 2001
Revision received March 1, 2002
Accepted March 3, 2002 ■