



A randomised trial of continuous skin-to-skin contact after preterm birth and the effects on salivary cortisol, parental stress, depression, and breastfeeding



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ABSTRACT

Aim: To evaluate the effects of almost continuous skin-to-skin contact (SSC) on salivary cortisol, parental stress, parental depression, and breastfeeding.

Study design: This is a randomised study engaging families of late preterm infants (32–35 weeks gestation). Salivary cortisol reactivity was measured in infants during a nappy change at one month corrected age, and in infants and mothers during still-face at four month corrected age. Both parents completed the Swedish Parenthood Stress Questionnaire (SPSQ) at one month and the Edinburgh Postnatal Depression Scale (EPDS) at one and four months. Ainsworth's sensitivity scale was used to control for parental sensitivity.

Subjects: Thirty-seven families from two different neonatal care units in Sweden, randomised to either almost continuous SSC or standard care (SC).

Results: Infants randomised to SSC had a lower salivary cortisol reactivity at one month ($p = 0.01$). There was a correlation between the mothers' and the preterm infants' salivary cortisol levels at four months in the SSC group ($\rho = 0.65$, $p = 0.005$), but not in the SC group ($\rho = 0.14$, $p = 0.63$). Fathers in SSC scored lower on the SPSQ subscale spouse relationship problems compared to fathers in SC ($p < 0.05$).

Conclusions: Almost continuous SSC decreases infants' cortisol reactivity in response to handling, improves the concordance between mothers' and infants' salivary cortisol levels, and decreases fathers' experiences of spouse relationship problems.

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1. Introduction

Preterm infants in neonatal intensive care are treated in a stressful environment and are exposed to several stressful interventions every day [1]. On top of that, the preterm infant is commonly separated from the mother. Mothers separated from their new-born infants often describe the separation as a major stressor [2]. Infants separated from their mother express a distress call that stops when the infant is returned to the mother [3]. Animal studies show that rodent pups are more sensitive to stress if they have been separated from their dams [4]. The combination of exposure to a stressful environment, stressful

procedures, maternal separation and brain immaturity increases the risk of disturbances in the hypothalamus–pituitary–adrenal (HPA) axis [5–7].

The HPA axis regulates cortisol production and the organism's capacity to respond to stressors. The HPA axis organises in early infancy in response to the environment, for example maternal contact or deprivation [4]. Maternal contact can buffer infant stress, while deprivation leads to higher sensitivity to stress [8]. Studies of rodents have shown that maternal licking and grooming alter the glucocorticoid receptor gene expression in the brain, lowering the corticosterone (rodents' equivalent to cortisol) reactivity [9]. On the other hand, social isolation increases the corticosterone reactivity in mice [10]. It has been suggested that environmental factors, such as spending time together and sharing the same environment, can enhance a concordance between the mother's and the infant's cortisol levels [11–16]. A correlation between mothers' and preterm infants' cortisol levels at discharge from the NICU has been described when the mothers were staying together with their infants, sharing the same environment around the

Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; HPA, hypothalamus–pituitary–adrenal; KMC, Kangaroo Mother Care; NICU, Neonatal Intensive Care Unit; NIDCAP, Newborn Individualized Developmental Care and Assessment Program; SC, standard care; SSC, skin-to-skin contact; SPSQ, Swedish Parenthood Stress Questionnaire

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clock [17]. Such a correlation in salivary cortisol levels was not found when the mother was not allowed to stay overnight at the ward [17]. A correlation in cortisol levels between twins sharing the same environment has also been described [17–19].

Parents need to be present and stay close to their infant to have the possibility to cherish and support the infant and thus buffer stress reactions. Therefore, providing facilities for parents to stay in the NICU to enable sharing the infant's environment is an important intervention [20]. Kangaroo Mother Care (KMC) is an intervention that has been used in neonatal care around the world for many years. The main components of KMC include skin-to-skin contact (SSC), where the infant lies between the parent's breasts firmly attached to the chest in an upright position, frequent and exclusive or near-exclusive breastfeeding, and early discharge from hospital [21]. SSC have proved to be beneficial for preterm infants, e.g. it contributes to cardiorespiratory stabilisation, fewer signs of stress, and a more organised sleep–wake cycle [22–24]. SSC may also improve co-regulation of salivary cortisol between mother and infant, attenuate the stress reactivity, and buffer the preterm infant's pain reaction during painful procedures [25–27]. For mothers, SSC reduces stress and postpartum depression, improves mood, encourages her to create a stimulating and caregiving environment, and to breastfeed [24,28–31]. In Sweden, SSC is initiated for extremely preterm infants at a median postnatal age of six days [32]. During the first days, the extremely preterm infant usually experiences SSC for a few hours a day. However, along with maturation, more and more hours may be spent in SSC with the parents, and eventually parents may carry their preterm infant in almost continuous SSC (i.e. almost around the clock) [33].

The experience of having an infant hospitalised in the neonatal intensive care unit is a highly stressful event for parents. Parents of preterm infants experience high stress associated with anxiety, uncertainty and parental role alteration [2,34,35]. Gray et al. compared stress in mothers of preterm infants with mothers of full-term infants [36]. They found significantly higher stress scores (measured with the parenting stress index) in mothers of preterm infants when the child was one year [36]. The various emotional responses including stress-related symptoms and depression experienced during the infant's first year may affect parents' ability to handle their parenthood and thus affect the development of the child. A number of studies indicate that postnatal depression can, besides being a severe state for the parent, be negative for the infant's development because it hinders the parent from detecting, interpreting and responding to the infant's signals in a sensitive and predictable way [37–39]. Depressed parents tend to be more passive and non-engaged in the interaction with the infant [40]. They also display more irritability and hostility towards the infant [40]. Infants to parents with depression are less good at self-regulating their emotions compared with infants to parents without depression [39]. However, there are some studies indicating that SSC can lower the risk for postnatal depression and parenting stress [24, 28,37].

Recently, Neu et al. presented data from a trial where mothers were holding their preterm infants for 1 h daily for eight weeks in either SSC, in a blanket or free of choice (control group). They found decreased cortisol levels in both mothers and infants in all three groups but no effect on cortisol co-regulation [41]. Neu et al. concluded that stress probably needs to be present in order for mothers and infants to demonstrate co-regulation of cortisol levels [41]. The most stress provoking intervention for infants besides separation from the parent is painful procedures [42]. However, to perform painful procedures without pain relief is not considered ethical. A nappy change has previously been used to evaluate stress reactivity in infants [43]. A nappy change is classified as a handling stressor for infants under three months age [42]. Still-face is a well used method to study infants' reactions to contradictory messages from the mother [44]. Still-face is best studied before six months age and is classified as a psychological stressor that elicits negative emotions [42].

Our thought is that if preterm infants are allowed to experience SSC around the clock, they may feel safe in a parent's care, receive the familiar olfactory stimuli and warmth from the parent's skin, and hear their heartbeat. All of these factors together may facilitate the maturation of the HPA axis and buffer the infant's stress reactivity. If parents are allowed to stay in the NICU and experience SSC day and night, they may be more tuned in to the infant's needs because they can feel all the infant's movements, and may be present the few minutes the infant is awake. The constant closeness may also influence the regularity of a day–night rhythm between the parent and the infant, and regulate the cortisol levels accordingly. However, a supportive maternal caregiving behaviour, such as high sensitivity and responsiveness to the infant's signals [45], may also buffer the infant's response to stressors, resulting in a lower rise in cortisol [46–50]. Hence, it is important to control for such quality.

1.1. Aim

The aim of the present study was to evaluate the effect of almost continuous SSC for late preterm infants (32–36 weeks of gestation). Primary outcome was salivary cortisol reactivity in response to two different stressful but non-painful situations at one and four month corrected age. Secondary outcome was to study the concordance between the mothers' and the preterm infants' salivary cortisol levels at four month corrected age. A third outcome was to study parental stress, depression, and breastfeeding.

2. Methods

2.1. Design

A randomised trial comparing outcomes of almost continuous SSC in one level-III NICU at Linköping University Hospital and one level-II NICU at Södersjukhuset, Sachs' Children's Hospital in Stockholm. Recruitment to the study took place between April 2008 and April 2012. The infants were randomly allocated to almost continuous SSC or standard care (SC) in relation to delivery by a staff nurse (Fig. 1). Allocation was done by sealed, opaque envelopes. The study was approved by the Regional Ethical Review Board at Linköping University (M30-07).

2.2. Setting

The health care system in Sweden allows both parents to stay in the NICU, and more and more NICUs offer family rooms [17,20]. Both NICUs participating in the present study are classified as family-centred wards, and they have 17 and 13 infant beds, respectively. There are separate rooms for each family, including beds for the infant and both parents, a private bathroom, and equipment for supplementary oxygen and telemetric wireless monitoring.

2.3. Definitions

In the current study, SSC was defined as almost continuous SSC, beginning in the delivery room and continuing almost 24 h a day with the parents alternating until hospital discharge. In the current study, SC means that both parents had the opportunity to practice as much skin-to-skin contact as they liked.

2.4. Inclusion criteria

Healthy women about to give birth vaginally to a single preterm infant (GA 32⁰–35⁶) without known malformation were eligible for participation. Participating mothers had to be able to read and speak Swedish.

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