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Behavior of the Newborn during Skin-to-Skin

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Abstract

Background: Early skin-to-skin contact (SSC) significantly increases the breastfeeding rate in healthy term infants.
Objective: This study aimed to confirm previously described behavioral sequences during SSC.
Methods: We recorded live and videotaped infant behavioral sequences during SSC in a cohort of healthy term infants, whose outcome was then evaluated.
Results: We studied 17 mother-infants dyads. While the majority of infants (59%) had behavioral phases that have been previously reported, some of them had alternative sequences. We observed the infant's massage of the mother's breast with its hand during SSC, which had not been previously reported. We found no correlations between behavioral sequence during SSC, breastfeeding, and neonatal outcome. Moreover, maternal pain stimuli did not affect the neonatal SSC behavioral sequence.
Conclusion: Our study confirms that immediate and undisturbed postpartum SSC is characterized by specific behavioral phases whose sequence may vary without affecting the suckling rate at the end of SSC, breastfeeding success, or the short-term neonatal outcome.

Keywords
breastfeeding, infant, maternal pain, skin-to-skin

Well Established

Early skin-to-skin contact (SSC) is characterized by specific behavioral phases whose sequence has not been extensively investigated, although it seems that its variation does not affect the suckling rate and breastfeeding success.

Newly Expressed

We documented a new behavior during SSC and confirmed that behavior sequence does not affect breastfeeding. The successful suckling rate at the end of SSC does not appear to be affected by maternal pain stimuli and does not affect the short-term neonatal outcome.

Background

Early skin-to-skin contact (SSC) is a practice that begins as soon as possible after birth and refers to placing the naked baby prone on the mother's bare chest.[1] A recent meta-analysis has demonstrated that early SSC significantly increases the breastfeeding rate in healthy term infants at 1 to 4 months postbirth, improves cardiorespiratory stability in late preterm infants, and increases the blood glucose level 75 to 90 minutes following birth.[1] It has also been demonstrated that SSC decreases a newborn's stress level, which is associated with separation from his or her mother,[2] and positively affects the transition from the womb to the extrauterine environment.[3]

Although the beneficial effects of SSC are well known,[1,2] the infant's behavioral sequence during SSC has been poorly investigated. Widström et al[4] have recently reported that the infant goes through 9 behavioral phases (birth cry, relaxation, awakening, activity, crawling, resting, familiarization, suckling, and sleeping) during SSC with its mother, which

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Table 1. Behavioral Phases, Adapted from Widström et al[4].

Phases	Behaviors
Birth cry	Intense crying just after birth
Relaxation phase	Infant resting/recovering; no activity of mouth, head, arms, legs, or body
Awakening phase	Infant begins to show signs of activity; small thrusts of head: up, down, from side-to-side; small movements of limbs and shoulders
Active phase	Infant moves limbs and head, is more determined in movements; rooting activity; "pushing" with limbs without shifting body
Crawling phase	Pushing that results in shifting body
Resting phase	Infant rests, with some activity, such as mouth activity, sucks on hand
Familiarization	Infant has reached areola/nipple with mouth positioned to brush and lick areola/nipple
Suckling phase	Infant has taken nipple in mouth and commences suckling
Sleeping phase	The baby has closed its eyes

may facilitate its ability to make use of all its senses, find the breast, reach the areola, and start suckling the nipple.

Thus, the primary research objective of this study was to evaluate the infant's behavioral sequence during SSC to confirm what has been previously described[4]; secondary research objectives were the evaluation of possible correlation between SSC behavioral sequence and breastfeeding success.

Methods

This prospective observational controlled study was conducted at the Margherita Birth Center of the Careggi University Hospital, Florence, Italy, from October 2012 to May 2013. After approval by the Ethics Committee of the Careggi University Hospital and informed parental consent had been obtained, we studied healthy infants with a gestational age of ≥37 weeks and birth weight appropriate for gestational age, born after uncomplicated pregnancy in Italian women by vaginal delivery without any kind of labor analgesia. Exclusion criteria were the occurrence of any event that could interfere with the newborn's spontaneous behavior during SSC, such as the need for mild resuscitation, biochemical blood measurements (ie, glycemia), or transient separation from the mother (ie, for manual removal of placenta).

Study Design

In the Margherita Birth Center, labor and delivery occur in the same room where mother-infant dyads stay until their discharge from the hospital. This study initiated immediately after birth: the infant was dried, avoiding hands and wrists (although there are not specific evidences, we believe that to leave amniotic fluid and mother's smell/flavor on newborn's hands and wrists may contribute to a more "natural" search of nipples), its head was covered with a dry cap and a warm blanket across the back, and it was placed naked and prone, skin-to-skin on the mother's chest, with its eyes level to the mother's nipples. The mother was asked to allow the infant to move naturally on her chest, but she could stroke and talk to the infant without restriction. Similarly, midwives were asked to not interfere with the newborn's movements, to not help the newborn reach the areola/nipple, and to limit ambient noise.

Mothers and infants were observed during SSC by real-time reporting of the time, duration, and sequence of neonatal behaviors on data sheets designed for this study. In particular, we reported the behaviors described by Widström et al,[4] as shown in Tables 1 and 2.

Contemporarily, mothers and infants were videotaped to allow subsequent reevaluation of neonatal behaviors by 2 other observers (A.C. and R.B.) so as to confute, confirm, or implement the initial examination. The video camera was directed at the upper part of the infant's body, including the face. The interobserver variability was preliminarily evaluated, and the observation congruity was found to be >85%. Each observation and videotaping was discontinued when infants entered their first suckling phase or sleeping period.

We recorded the age, number of pregnancies, parity, labor duration, and need for perineal laceration repair for each mother. We recorded the following data for each infant: gestational age, birth weight, length, head circumference, Apgar score at the first and fifth minutes, arterial cord blood pH, weight loss at 24 hours of life and at discharge, need of phototherapy, and breastfeeding rate at discharge and at 1 month of life (phone interview).

For the purpose of our study, breastfeeding was defined according to the World Health Organization[5] as "an unequalled way of providing ideal food for the healthy growth and development of infants"; exclusive breastfeeding is defined "as no other food or drink, not even water, except breast milk (including milk expressed or from a wet nurse) for 6 months of life" but allows the infant to receive vitamins, minerals, and medicines.

Statistical Analysis

Data were described by mean values and standard deviation, or rate and percentage, or median value and interquartile

Table 2. Behaviors Not Restricted to a Specific Phase, Adapted from Widström et al[4].

Behaviors	Definition
Eyes	Closed or opened
	Looks mainly at mother's breast
	Looks mainly in the direction of the mother's face
Soliciting sounds	An affirmative, short, ringing sound
Hand-to-mouth	Hand in/or touching the mouth
Hand-breast-mouth	Infant moves hand across mother's breast and brushes the nipple/areola and brings hand to mouth
Hand-breast-massage	Infant massages the breast with the fist or open hand
Rooting	Twisting movement where face is brought across or lifted above mother's chest and turned to side or hand
Rocking/pushing	Rocking activity without shifting position

range. Although the comparison of data from different studies is not completely appropriate, we compared the behavior rate observed in our population to that of Widström et al[4] for allowing the immediate evaluation of possible differences. We could not make a similar comparison of the timing of the appearance of each behavior phase because the previous study[3] reported median values and interquartile ranges of this variable that do not permit a statistical comparison.

To assess the possible correlation between the occurrence of some behavioral phases during SSC and the suckling success rate, we compared the frequency of these phases in infants who were able to suckle at the end of SSC to that of infants who were not. The possible effects of maternal pain stimuli on the SSC behavior sequence was evaluated by comparing the frequency of each phase in infants whose mother had perineal laceration repair to that of infants whose mother had not.

Comparisons were made using Fisher's exact test for categorical variables. A $P < .05$ was considered statistically significant.

Table 3. Clinical Characteristics of Mother-Infant Dyads (n = 17).

Demographic and Clinical Data	Mean (± SD) or Proportions (%)
Mothers	
Age, y	33 ± 3
No. of pregnancies	2 ± 1
Parity	1 ± 1
Primiparae	10 (59)
Labor duration, h	3 ± 2
Infants	
Birth weight, g	3348 ± 385
Gestational age, w	39 ± 1
Head circumferences, cm	34 ± 1
Total length, cm	50 ± 1
Apgar score	
1 min	10 ± 1
5 min	10 ± 0
Arterial cord blood pH	7.29 ± 0.07

Results

We enrolled 17 mother-infant dyads whose clinical characteristics are reported in Table 3. The frequency of behavioral phases was similar to what has been previously reported,[4] except for mouth activity in the awakening and sleeping phases after suckling, which were less frequent in our population (59% vs 100%, $P = .001$). The SSC ended with suckling in 41% of our infants.

The sequence of behavioral phases disagreed with Widstrom et al's[4] sequence in 41% (7/17) of our newborns (Table 4). We observed that the order of cry, relaxation, and awakening phases was different. In detail, in 2 infants (12%) cry followed the relaxation phase, in 1 infant (6%) the relaxation phase followed the awakening phase. Moreover, the resting phase occurred not only after the active phase (6/17; 35%) but also after crawling (6/17; 35%) and familiarization (5/17; 29%) phases.

Although we could not make an exact statistical comparison of time of appearance of behavioral phases, we observed that they seem to appear at a similar time (minutes) in ours and Widstrom et al's[4] populations, although active and sleeping phases were slightly delayed and hand-breast-mouth movement and suckling phases were slightly anticipated (Table 5). It is interesting that 76% (13/17) of our infants showed hand-breast-massage movements that Widström et al[4] did not mention. This behavior was more common during the active and resting phases, but we observed it also during the awakening, crawling, and familiarization phases (unreported data).

The SSC ended with effective suckling in 41% (7/17) of infants at the median age of 45 minutes (interquartile range [IQR] = 39-56 minutes). The remaining infants started suckling the breast within the first 24 hours of age.

The sequence of behavioral phases was similar in infants who began suckling at the end of SSC or did not, except for the infant's hand massage of the breast, which was less frequent in the former (43% vs 100%, $P = .014$). Moreover, maternal pain stimuli did not affect the neonatal SSC behavioral sequence.

Table 4. Behavior Phase Frequency during Skin-to-Skin Contact in Our Population (n = 17) Compared to Widström et al's[4] study (n = 28).

Behavioral Phases	Our Population Proportions (%)	Widstrom et al[4] Proportions (%)	*P*
Birth cry	17 (100)	28 (100)	N/A
Relaxation phase	13 (76)	24 (86)	.402
Awakening phase			
Head movements	17 (100)	28 (100)	N/A
Opening of the eyes	17 (100)	28 (100)	N/A
Mouth activity	10 (59)	28 (100)	<.001
Active phase	17 (100)	28 (100)	N/A
Eyes stay open ≥5 min	17 (100)	26 (93)	.519
Looks at breast	16 (94)	25 (89)	1.000
Looks at mother	14 (59)	24 (86)	1.000
Rooting	17 (100)	25 (89)	.279
Hand-to-mouth movements	17 (100)	28 (100)	N/A
Hand-breast massage	13 (76)	N/A	N/A
Soliciting	17 (100)	25 (89)	.279
Resting phase	17 (100)	25 (89)	.279
Crawling phase	16 (94)	21 (75)	.132
Familiarization phase	11 (65)	18 (64)	.618
Hand-breast-mouth movements	11 (65)	9 (32)	.062
Suckling phase	7 (41)	15 (54)	.542
Sleeping phase	10 (59)	28 (100)	<.001

Abbreviation: N/A, not applicable.

Table 5. Time of Appearance (Minutes) of Behavioral Phases during Skin-to-Skin Contact in Our Population (n = 17) Compared to Widström et al's[4] Study (n = 28)[4].

Behavioral Phases	Our Population Median (IQR)	Widstrom et al[4] Median (IQR)
Birth cry	0 (0-0)	0 (0-0)
Relaxation phase	3 (1-6)	2 (2-4)
Awakening phase		
Head movements	5 (2-7)	2.5 (1-5)
Opening of the eyes	5 (0-8.5)	3.5 (1-7)
Mouth activity	6 (2-18)	3 (2-16)
Active phase	13 (10-25)	8 (4-12)
Eyes stay open ≥5 min	7.5 (4-11)	9.5 (6-16)
Looks at breast	9.5 (6-18)	15 (0-53)
Looks at mother	13.5 (5-20)	15.5 (11.5-21.5)
Rooting	31 (18-38)	17 (12.8-23.5)
Hand-to-mouth movements	12 (5-23)	18 (9-31)
Hand-breast massage	28 (12-52)	N/A
Soliciting	8 (6-17)	23 (17.5-32.5)
Resting phase	20 (15-38)	18 (13-26.5)
Crawling phase	28.5 (21-48)	36 (18-54)
Familiarization phase	46 (24-52)	43 (29-62)
Hand-breast-mouth movements	31 (12-47)	46 (32.8-70.5)
Suckling phase	45 (39-56)	62 (43.5-90.3)
Sleeping phase	94 (78-108)	70 (52.5-79)

Abbreviation: IQR, interquartile range; N/A, not applicable.

Weight loss, need of phototherapy for jaundice, and exclusive breastfeeding were similar in infants who began suckling at the end of SSC and in those who did not. It is noteworthy that all studied infants were exclusively breastfed not only at 24 hours of life and at discharge from the hospital but also at 1 month of age.

Discussion

In this study we aimed to evaluate the infant's behavioral sequence during SSC immediately after birth to confirm what has been previously described by Widström et al[4] and to document the possible occurrence of other behavioral phases.

Fewer of our infants were able to start suckling at the end of SSC than in the Widstrom et al[4] study (41% vs 54%). This might be explained by the higher number of primiparous mothers in our population (59% vs 43%), since multiparity favors the development of maternal holding capacity,[6,7] and a multiparous mother might spontaneously and more effectively induce her newborn to the nipple.

While the majority of our infants (59%) had the same phase sequence reported by Widström et al,[4] a relevant percentage (41%) had a different one. We observed that some phases, such as resting, can be inserted between other phases, such as the active phase, crawling, and familiarization. This might be due to the infant's need to rest following phases of great energy expenditure. Therefore, our findings suggest that the sequence of neonatal behaviors during SSC is flexible and changes among different mother-baby dyads. It may be speculated that some infants need to repeat 1 or more phases to confirm a learned behavior or to test what is the most appropriate response to environmental and sensorial stimuli.[8-12]

The sleeping phase was less frequent in our infants than in the Swedish population,[4] but they studied infants "from birth to first suckle or first sleeping period," and it is unclear how the sleeping phase could be observed in infants who suckled before sleeping and had their examination interrupted. However, it is interesting that, as for the resting phase, the sleeping phase was more frequent in infants who did not suckle at the end of SSC, as if they had a huge energy expenditure requiring a resting phase.

We observed a behavior never described before during SSC, namely, the infant's massage of the breast performed with the fist or open hand mainly during the active and resting phase. This massage may be very useful for breastfeeding, being a powerful stimulus for maternal oxytocin release.[13] This behavior was more frequent in infants who did not suckle at the end of SSC, suggesting again that infants who expend more energy have less probability of ending SSC with effective breast suckling.

In our population, maternal pain (ie, secondary to perineal laceration repair) did not affect neonatal behavioral phases during SSC. We speculated that mothers divert their attention so briefly from the infant that the mother-infant interaction is not negatively influenced.

Our findings indicate that effective suckling at the end of SSC is not related to the neonatal short-term outcome, namely, weight loss and jaundice rate of infants. On the other hand, all our infants had successful exclusive breastfeeding at discharge and at 1 month of life. This confirms that the actual importance of an immediate postpartum SSC is the SSC itself and not the infant finally achieving suckling, as underlined in step 4 of the of the revised Baby-Friendly Hospital Initiative.[14] In fact, the achievement of mother-infant SSC is an accurate predictive factor of subsequent exclusive breastfeeding and a well-structured mother-infant bonding,[1,15-20] probably because, as previously demonstrated in a randomized controlled study,[3] SSC beneficially influences state organization and motor system modulation of the newborn infant shortly after delivery, increasing his or her independent self-regulation in face of the inevitable increase of extrauterine environmental stimulus. However, we believe that our results in obtaining exclusive breastfeeding data were also favored by the great attention and involvement of midwives and mothers in supporting breastfeeding that is typical of midwife-led units, such as the Margherita Birth Center.

The limitations of our study include the small size of our population, mainly due to the denied informed parental consent by those wishing to preserve the privacy of the first postpartum hours, but given the homogeneity of our population, it is unlikely that a population substructure could affect our observations; the lack of using a score for measuring maternal pain; and the need to explain many observations through rational speculation, due to lack of knowledge in this field.

Conclusion

Our study confirms that immediate and undisturbed postpartum SSC is characterized by specific behavioral phases whose sequence may vary without affecting the suckling rate and breastfeeding success. We documented a new behavior observed during SSC, namely, the infant's massage of the mother's breast. We observed that the successful suckling rate at the end of SSC is not affected by maternal pain stimuli and does not affect the neonatal short-term outcome. Our findings are consistent with the concept that the effect of SSC is not only the quick start of breastfeeding but also the widespread beneficial role in the development of adequate mother-infant bonding of which exclusive breastfeeding is one of the more evident and important expressions.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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