The senses of touch and olfaction in early mother–infant interaction

Abstract

What happens between mothers and their infants has considerable developmental and functional significance. Mother–infant verbal and nonverbal communication is highly complex and notably reciprocal in nature. These exchanges are influenced by multiple factors and affect the formation of mother–infant ties and the co-regulation of emotions, physiology and motor behaviours. How the senses help to mediate these interactions and influence relationship quality is an important and diverse area of human biology and relationship study. This article will explore the contributions of two of the important nonverbal senses, touch and olfaction, on mother–infant interactions in the period shortly after birth.

Keywords: Infant development, Mother–infant interaction, Touch, Smell

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For the human newborn, being able to recognise (and be recognised by) his/her own mother, locate the breast, latch on and feed are clearly evolutionarily important survival abilities. Clear indication of these innate abilities and the biological systems that control these behaviours exists. Infants born at term are broadly equipped with all the sensory systems of adults. However, some specific sensory abilities are less advanced than those seen in adults. Examples of this sensory limitation include, reduced visual acuity and focusing distance (Braddick and Atkinson, 2011) and challenges in integrating complex, multiple and simultaneous stimuli, particularly for those born preterm (Wickremasinghe et al, 2013). This article focuses on two important non-verbal/non-visual aspects of the newborn sensory world and considers their contributions to mother–infant interactions in the time shortly after birth. These senses are olfaction (smell) and the medley of tactile stimuli collectively referred to as touch. These two senses are thought to be highly significant in how infants self-regulate their physiology and behaviour (Barnard and Brazelton, 1990; Schaal and Durand, 2012).

The nature and number of the senses in humans

The term sense is linguistically derived from the Latin word 'sentire' meaning to feel and realise. In the past humans were regarded as having only five senses: hearing (auditory), sight (visual), touch, taste and smell (olfaction). However, modern ideas have increased this number by recognising additional senses and developing more sophisticated explanations of existing senses that reflect greater physiological understanding. For example touch is now often differentiated into sensations of pressure, vibration, itch and the like (Stack, 2010). In addition, kinaesthetic, motion/acceleration and temporal (time) sensitivities and others are viewed as components of the human sensory world (Goldstein, 2014). As a consequence debate exists about the exact number of human senses with figures of six and nine to over 20 featuring in popular and academic accounts. Much of this debate seemingly stems from how a sense is defined and distinguished. That is, whether a sense requires identifiable neurosensory apparatus to exist or that a sense broadly equates to having an awareness (conscious or unconscious) of something (external or internal). Regardless, it is clear that the human sensory repertoire is much wider than historic assumptions.

Mother–infant interactions in the early newborn period

Early sensory exposure during fetal life begins through contact with the odours and taste of amniotic fluid, internal maternal body sounds and rhythms and dampened external stimuli. This early learning might be important in subsequent preferences (Varendi et al, 1996; Breslin, 2013). Normal sensory development and differentiation involves the simultaneous movement and growth of a variety of tissue types (de Graaf-Peters and Hadders-Algra, 2006). Like most organ's systems, the embryonic development of the body's sensory apparatus is complex and is laid down in the basic embryonic body plan (Moore and Persaud, 2008). This process is largely anatomically completed during fetal life but protracts for some years after birth. After birth, infants are exposed to an increasingly diverse, complex and intense range of sensory stimuli (Brazelton and Cramer, 1991); some of these serve to support the physiological transitions of birth including the onset of breathing (Van Woudenberg et al, 2012). Evidence about the importance of tactile stimulation to these transition events and later development is widespread in both human and animal studies (Stack, 2010).

There is an emerging consensus that early social experiences can have wide-reaching lifelong physiological and developmental effects for infants and mothers (Klaus et al, 1970; Als et al, 2004; Bystrova et al, 2009; Champagne, 2010; Gudsnuk and Champagne, 2011). Stack (2010) argues that the purposes of mother–infant interaction throughout infancy are to support the development of emotional attachments, social understanding and language acquisition. However, this list is incomplete and could be readily extended to include greater maternal–infant synchrony through mutual autonomic and emotional regulation. Past ideas that viewed infants as passive recipients of maternal attention have been largely superseded by others that view these relationships as a mutual and creative processes (Brazelton and Cramer, 1991). Synactive theory, first proposed by Als (1982), is a widely held explanation of how infants interact with their external world. This model has become adopted as a key theoretical foundation underpinning concepts of developmentally supportive care. While commonly applied within neonatal care settings, the concept is equally applicable in more usual postnatal contexts.

Touch in early interactions

The sense of touch is used to explain the tactile stimulations arising from physical contact with something. Touch is often differentiated at a physiological level to include additional tactile sensations like pressure, temperature, pain, stretch, tickle, vibration and itch, for example. Being touched can be quietening, alerting, comforting or arousing, pleasant or unpleasant depending on the situation, its intensity and rhythm, for instance (Brazelton and Cramer, 1991). Consequently, touch plays a fundamental role in the development of human relationships (Barnard and Brazelton, 1990) and is an important medium of communication between mothers and their infants (Sack, 2010). Early physical contact between mothers and their infants can facilitate and reinforce emotional attachments and also have a number of other clinically important benefits (Bystrova et al, 2009; Phillips, 2013).

One Cochrane study (Moore et al, 2012) systematically reviewed 34 randomised trials involving 2177 participants, which used early skin-to–skin contact between mother and term infant dyads as an intervention. They found that despite considerable variation in methodological quality and heterogeneity in how skin-to-skin was implemented, early contact promoted more mother–infant interaction, less infant crying and greater cardio-respiratory stability, and more breastfeeding (both initiation and longer duration) in the first 4 months. These findings have been replicated in studies of similar skin-to-skin interventions with preterm infants who also report additional long-term beneficial effects. For infants these include: increased weight gain, physiological stability, better sleep, reduced pain and improved breast milk volume. For parents, the benefits include: increased self-esteem and confidence, reduced anxiety and symptoms of depression (Blomqvist, 2012; Bera et al, 2014; Conde-Agudelo and Díaz-Rossello, 2014; Feldman et al, 2014).

The psychological calming effects of skin-to-skin contact for infants and their mothers are well recognised. It was also established some time ago that infants prefer to hear their mothers own voice in contrast to other auditory stimuli (De Casper and Fifer, 1980). Despite this, the potential effects of combining different sensory inputs are not widely explored and warrant further study. One study of 86 stable preterm infants found that combining skin-to-skin care with simultaneous maternal singing (using a repetitive soft soothing tone) were complementary and had additive effects (Aron et al, 2014). Mothers' anxiety scores were lower and infants exhibited greater autonomic stability (reduced heart rate variability) during the intervention (Aron et al, 2014). In several respects this was a limited study but, if replicable in other contexts and with other groups of infants, this finding could add credence to using synergistic sensory stimuli in practice.

Research worldwide has generated support for the contention that skin-to-skin contact at birth and afterwards benefits mother (and father) and infant wellbeing and when done according to established techniques has few problems. Implementing routine skin-to-skin care is often incorporated into a wider change strategy that seeks to promote baby and mother friendly services. This might mean that some of the reported benefits of skin-to-skin stem from the adoption of a more inclusive empathic stance towards parents rather than the intervention itself.

Odour in early interactions

The nascent chemosensory apparatus of olfaction develops early in pregnancy (Moore and Persaud, 2008). It seems likely that pre-birth olfactory experiences help establish infant response to odourants after birth. For example, familiarity with amniotic smell might explain the calming effects of amniotic fluid (Varendi et al, 1998;

Goubert et al, 2007). In some mammalian species odour plays an indispensable role in moderating mother–offspring behaviours; this is not the case in humans (Levy et al, 2004). Nevertheless, olfaction appears to provide important cues to help guide interaction between infants and their mothers.

Based on clinical observation that infants were invariably able to locate the breast without assistance, Varendi and colleagues (1994) suspected a role for maternal breast odour in this navigational ability. Their study, while small, (n=30) was able to demonstrate that 22 of the infants placed between their mother's breasts freely choose the unwashed breast. This led them to conclude that infants preferred the smell of the unwashed breast and they advocated that mothers should avoid unnecessary routine cleaning of the breast as it might interfere with breastfeeding success. Follow-up studies (Varendi and Porter, 2001) were able to demonstrate that infants when placed prone preferentially moved towards pads containing their mothers' breast odour. Based on their analysis they suggested that breast odour alone was sufficient to provide cues to guide infants toward the breast.

Much of the evidence highlighting an infant's preference for particular odours, notably its mother's scents (breast milk, sweat and amniotic fluid) has been obtained from experimental situations in which infants were provided with choices of different odours. However, given the small scale and limited statistical analysis, the findings should be treated with caution. Nevertheless, subsequent investigations of infants' ability to distinguish olfactory cues give credence to claims about the importance of smell in modulating mother–infant interactions (Delaunay et al, 2006; Doucet et al, 2007). Exposure to familiar odours in stressful situations like those that can occur in hospital settings can be reassuring to infants (Kawakami et al, 1997; Sullivan and Toubas, 1998) and, in the case of breast milk odour, help to prepare the infant's physiology for feeding (Coffield et al, 2014).

An infant's ability to discriminate the smell of its mother's body odour and breast milk is not unique. Mothers also seem capable of identifying their own infants through their natural smell alone. A small novel experimental test found that some new mothers (3–5 days postpartum) presented with two or three choices of infant body odour on T-shirts were able to distinguish their own infant's odour (Fleming et al, 1995). Women who were able to consistently do this had greater prior maternal experience and a shorter interval of time before first contact with their infant after birth; suggesting more advanced human olfactory abilities than often supposed.

Olfactory sensory stimuli can help infants recognise their own mothers and orientate towards the breast after birth. In addition, the familiar smells of amniotic fluid, breast milk and maternal body odour can help them to find solace during stressful experiences.

The challenge of environmental fragrance

Fragrances are a diverse range of substances that impart a pleasant odour. Some fragrances (natural or synthetic) are potentially detrimental to individual health or the environment (Greenpeace, 2005; Cheng and Zug, 2014). In hospital settings infants are exposed to numerous strong odours such as those found in cleaning solutions—antibacterial cleansers e.t.c. Strong odours could potentially overwhelm the olfactory sensorium of the newborn. However, the consequences, if any, are not well understood and require further study.

In the UK, artificial fragrance use is widespread in personal care, laundry and household products. This common practice has extended in recent years into aspects of infant care beyond the usual scope of skin hygiene products and extended to include so-called 'infant perfumes and colognes'. Some commentators on social media have condemned these products as symptomatic of the commercialisation of parenthood and an unnecessary intrusion into the infant's olfactory experience. In contrast, all parents are invariably influenced by social and cultural ideas about how their infant should appear, feel and smell and their choices (so long as they are not harmful) should arguably be accommodated. It has been suggested that low concentrations of fragrance ingredients derived from natural sources are well tolerated (Coret et al, 2014). However, the best general advice would be to limit exposure to non-human odours and only use products that are designed for and proven to be safe for use with infants.

Integrating multiple sensory modalities: the breast crawl

The first hours after birth are recognised as important in establishing mother–infant relationships (Royal College of Midwives (RCM), 2010). One early observational study identified that newly born infants and their mothers engaged in an orderly and predictable pattern of behaviour shortly after birth (Klaus et al, 1970). This behaviour involved reciprocal eye-to-eye contact, 'mutual gazing', and touching. Mothers, at first, tended to use the tips of their fingers to

examine their infants and over a short space of time change to increasingly use their palms more. Some have speculated that this innate behaviour is likely to be important precursor in helping to establish affectional bonds, pre-empting greater mutual exploratory behaviours (Barnard and Brazelton, 1990) or subsequent emotional regulation in infancy (McLean et al, 2014).

Skin-to-skin contact involves multisensory stimuli and not just the senses of touch, for example olfactory, thermal and auditory sensations also feature in the experience. Skin-to-skin contact between mother and infant in the time shortly after birth enables virtually the full repertoire of human senses to come into play and this might aid infant neurological integration, self-regulation and mother–infant synchrony. There is a significant body of naturalistic and empirical evidence based on observational study that newly born infants placed in skin-to-skin contact with their mother's abdomen exhibit a predictable sequence of behaviours going through nine stages that culminates in the infant moving towards the breast and initiating feeding behaviours. First described in the 1980s and later expanded on (Widström et al, 1987; 2011) this phenomenon has become popularly referred to as the 'breast crawl'. The routine confirmation of these events and their contribution to infant physiological transition, stability and breastfeeding success has led to calls that uninterrupted skin-to-skin contact during the first hour after birth should be the norm of mothers postnatal care experience regardless of mode of delivery (Phillips, 2013; Stevens et al, 2014). To support this aim, routines of midwifery care and organisational policies should be modified to ensure this goal is attainable. Guidance on how to do this is readily available in the professional literature (RCM, 2010).

Institutional policies and practices comprise an integral part of mothers' experience of health care delivery and some of these can adversely affect mother–infant interactions (Bystrova et al, 2009). Poor timing of infant weighing or the administration of vitamin K can interfere with an infant's progress in the aforementioned breast crawl to the extent that when removed from his/her mother's abdomen even if only for a short time, the opportunity to complete this behaviour cycle is lost (Phillips, 2013). The sensations of touch mothers and their infants feel during skin-to-skin are evidently important in supporting breastfeeding. However, the beneficial effects of mutual maternal–infant touching are not solely restricted to mothers who choose to breastfeed. It seems likely that all forms of gentle mutual touch, including massage (Cooke, 2014), have the potential for benefit. Midwives can play a role in shaping the postnatal physical and social environment and are ideally situated to advocate for changes in practice and the way care is organised to be more responsive to infant needs and rewarding for mothers and fathers alike.

ISTOCK PHOTO

The benefits of skin-to-skin contact to both mother and baby are well known

Conclusion

Taken together, smell and touch seem to be important components that help to guide behaviour and facilitate reciprocity during mother–infant communication. These sensory interactions can serve to reinforce attachments and aid co-regulation. During the infant's first hours, those left in skin-to-skin contact with their mother's abdomen follow a predictable sequence of behaviours: they gradually move towards the breast, touch the breast and begin to suckle. The exact mechanisms that guide these behaviours are thought to involve numerous sensory stimuli including vision, sound, touch and olfaction. Routine care practices and organisational policies that interrupt this contact time can have adverse effects on these interactions and subsequent behaviours. Midwives should advocate for routine uninterrupted mother-infant skin-to-skin contact during the first hours after birth irrespective of feeding choice and mode of delivery. BJM

Key points

- Traditionally humans were credited with having five senses; however, modern ideas suggest that the true figure is likely to be larger
- Newborn infants are equipped with the ability to be aware of, comprehend and interact with their external physical and social environment; they do this partly through the interpretation of sensory stimuli
- The senses of olfaction and touch play a fundamental role in early mother-infant interactions
- Having an understanding of the importance of the entire human sensory repertoire in mother–infant communication can help midwives to ensure a more sensitive and supportive post birth transitional experience for mothers' and their newborns

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