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REVIEW ARTICLE

Imprinting, latchment and displacement: a mini review of early instinctual behaviour in newborn infants influencing breastfeeding success

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ABSTRACT

Instinctive behaviours have evolved favouring the mother–infant dyad based on fundamental processes of neurological development, including oral tactile imprinting and latchment. Latchment is the first stage of emotional development based on the successful achievement of biological imprinting. The mechanisms underpinning imprinting are identified and the evolutionary benefits discussed.

Conclusion: It is proposed that the oral tactile imprint to the breast is a keystone for optimal latchment and breastfeeding, promoting evolutionary success.

INTRODUCTION

Imprinting is the term which was chosen by Konrad Lorenz in 1935 to describe the rapid visual acquisition of the ability of newly hatched goslings to recognise and socially bond to the mother for evolutionary survival (1).

Lorenz was surprised that most precocious birds did not recognise their species through instinct. He found that the first three-dimensional representation of a moving sighting had by the newly hatched gosling, would be visually recognised as the mother. The recognition would occur at a sensitive time, usually near the day of hatching, and a following response would become established even when the sighting was an inanimate decoy. Similar social reactions are readily released in the human infant by other than the genetically based biological object as we see with a decoy bottle teat/pacifier/dummy/thumb replacing the absent or deprived maternal nipple when the newborn has not been given the opportunity to orally imprint with the mother's breast during the stage of alertness following birth and preceding sleep. The infant may awaken sometime after the post-birth sleep and find its decoy mother, commonly the self-thumb unless a dummy has already been introduced, while the real mother sleeps. Imprinting has been extensively studied in precocial birds such as geese, ducks and chickens (1–4).

This study aims to review the process of mammalian imprinting, focusing on human term newborn behaviour, imprinting and latchment. Such an understanding may assist

Key Notes

- Imprinting and subsequent latchment is a primary stage of emotional and neurobehavioural development in which the infant recognises its mother through oral tactile memory for continuing evolutionary survival.
- Displacement of the normal imprint from the mother's breast may lead to a range of adverse outcomes for both mother and her infant.
- Elucidating these processes and their consequence on development may assist in generating improved strategies for breastfeeding and neonatal development.

in breastfeeding strategies and secondary nutritional and immunological newborn development. Human mammalian imprinting has previously been investigated, initially without discovery of a process (5). Mobbs, in 1989, hypothesised that the human behavioural imprint was mediated by oral tactile sensory stimuli and was necessary for evolutionary survival (6). This hypothesis was supported by the finding that one teat preference was predominant across the mammalian spectrum with humans included (6,7). The human baby deprived of the mother's breast has been observed to suck one digit or combination of digits out of ten to the exclusion of all others and become distressed if the imprinted decoy is physically denied (6). Thumbsucking is the earliest and most common habit in children affecting as many as 45% of the young population in the world (8). From birth through adolescence decoy, non-nutritive sucking of an unique object has been significantly correlated with jaw and dental problems in both first and permanent teeth (8,9). Oral tactile recognition is achieved through Merkel cell mechanosensors. Merkel cells proliferate in the human foetus from the ninth gestational week and spread through a significant part of the buccal mucosa with an appropriately related neuronal coverage in the sensory cortex (10). The behavioural observations that we see are consistent with the hypothesis of Merkel cell sensory nerve mechanotransduction supporting the learning mechanism of human imprinting (11,12).

For the purposes of this review, the literature was extensively and objectively researched using Google Scholar, Medline, PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). Articles were qualitatively assessed for their relevance to 'imprinting', 'latchment' and 'attachment' in the newborn. Articles were unrestricted regarding language, but only those written in English were included. The use of certain key terms is made within this paper, and we believe that consistency in understanding these definitions will lead to improved infant care (Table 1).

Table 1 Definitions regarding imprinting, latchment and displacement in the human mammal

Imprinting	The behavioural process that takes place during a sensitive period in the early hours of life during which the baby's evolutionary biology enables it to orally fixate to a stimulus feature (normally the mother's nipple and the surrounding milking area) and learn its tactile characteristics (13)
Latchment	The first emotional stage of development during which the baby recognises its mother through the oral tactile perception of the stimulus feature in the mouth for evolutionary survival ('mother in the mouth') (13)
Attachment	This is the second emotional stage of development commencing sometime after six months when the baby visually recognises its mother as a whole person ('mother in the eye'). During this biologically instinctive attachment phase, the baby will seek close proximity to its mother as a safe haven for evolutionary survival and as a secure base from which to explore and become independent. Attachment is a behaviour directed by the infant to the carer, and the characteristic is a predictor of social and emotional outcomes (14,15). Latchment behaviour is maintained during the attachment phase as baby will seek and continue non-nutritive sucking of the stimulus feature (14,16). This phase continues throughout toddlerhood
Bonding	The repeated behaviour chosen by the caregiver (attachment figure) to support the infant physically and emotionally and facilitate the release of the infant's instinctive ability to attach to the caregiver for evolutionary advantage (16)
Latch and latching	The physical positioning of the mother's nipple and the milking area of the breast within the baby's oral cavity
Decoy	Any object (pacifier, dummy, thumb, bottle, teat, etc.) that replaces the stimulus feature which evolution designed (mother's breast). 'Pacifier' is a marketing term or branding device with the pretence to normalise the use of foreign objects
Displacement	The transference of an imprint to a decoy (17)
Imprinted object	The Imprinted Object is that upon which the baby is emotionally fixated (breast, thumb, dummy, pacifier, bottle teat or other decoy). The fixation is most evident at sleep time when baby can only be comforted by the imprinted object
Maternal nipple deprivation	The mother's unwillingness to allow baby normal access to the nipple (often in response to extraordinary societal pressures and the absence of role modelling)

EARLY INSTINCTUAL BEHAVIOUR IN ANIMALS AND NEWBORN INFANTS

Imprinting

Sluckin in 1970 identified five principal tests that, if satisfied, would identify imprinting in precocial birds (18).

- Choice test
- Recognition at reunion test
- Distress at separation test
- Run to mother test
- Work for reunion test

These tests can be used, with some modification, to identify imprinting in other species. A newborn survival instinct is fundamental to each branch of the animal kingdom with the expectation that converging features lead to success. Mobbs in 1990 modified Sluckin's tests to suit the semi-altricial human mammal as follows (7).

Choice test

The newly born human baby held in the mother's arms, eyes at nipple level, skin to skin, front to front, in a position of comfort for the mother and safety for the baby, may be favoured by breast odour as the initial maternal directional stimulus to guide the baby to the breast (19).

Sequential spontaneous behaviour of wide eye opening followed by the seeking mouth gaping and the tongue

moving downwards and forwards, usually in the first fifteen minutes of life, signals the mother, who has evolved as an active participant in the latching process, of the nearing readiness to feed (20,21).

The neonate's instinctual goal-directed behaviour continues, and aided by proximity for visual accommodation, a response to a specific stimulus feature of the mother, the mother's nipple and the surrounding pigmented milking area, ensues and baby is now ready to draw the breast into the mouth for the first feed (22).

Oral tactile recognition

Mobbs in 1989 proposed that the activation of Merkel cells in baby's buccal mucosa in response to a tactile stimulus was the first step in oral recognition of the nipple and milking area of the breast as 'mother in the mouth' (6). Virtually all vertebrates have a buccal region rich in Merkel cells, and these have been of scientific interest as they were identified in 1875. Their main function is as a mechanoreceptor of tactile stimuli. Mechanotransduction as part of our evolutionary process dates back to single cell organisms 1.7 billion years ago (23).

The Merkel cell–neurite complex receives information through mechanosensation in the buccal mucosa and passes on an encoded neural image of the imprinting object to the baby's central nervous system. The encoded features embrace shape, edges and curvatures. The response is maintained throughout the stimulus which allows these cells to distinguish two points of discrimination close together which includes texture. This is the process which identifies fine spatial details such as Braille-like characters (24). The buccal region of the human has a sensory innervation well represented by Penfield's sensory homunculus. This region is comparable to the sensory human hand with a large area of the cerebral cortex devoted to it to facilitate imprinting through teat identification (25).

One teat preference

Mobbs observed that a human baby would suck one digit out of ten to the exclusion of all others and to a degree of excoriation and pain (6). Mobbs also observed that orphaned, human-reared, maternal nipple-deprived mammals could suck down to the bone of the digit chosen to replace the displaced mother (26). The choice of such a single object preference decoy was a feature seen across the mammalian spectrum and consistent with the memory enabled through Merkel cell sensory identification and the emotional consequence of latchment (13).

Maternal teat preference supports the evolved physiological correlate of feedback inhibition of lactation and autonomy of the breast (27). The following sample of mammals demonstrates teat preference: pigs, hyrax (an elephant relative), domestic kittens, Antechinus (marsupial mouse), kangaroos, marmosets, pine voles, snow leopards, chimpanzees and humans (13). If oral tactile recognition of a non-nutritive object as the mother occurred in animals, this would preclude survival of the individual without human intervention. The concept of one teat preference extends to decoy pacifiers/dummies with human infants showing emotional distress following change of object shape or texture as the new pacifier/dummy replaces the old (28). These are the behaviours of Merkel cell encoding recognition (oral tactile memory) promoting teat preference fixation.

Newborn returns to stimulus feature

The baby's discovery stimulus of the nipple and surrounding pigmented milking area is initially innate through odour and visual feature recognition (19). The oral tactile imprint is a learnt form of perceptual recognition via Merkel cell mechanosensation which governs the imprinting process (24). The baby's return to the nipple ('mother in the mouth') is an emotionally directed process termed 'latchment' (9). The latchment phase serves its strategy for evolutionary survival until the infant is able to recognise the mother visually as a whole person sometime after six months of age when the emotional relationship is termed 'attachment' (14,16). The first emotional relationship latchment period, although nameless until described by Mobbs, has been broadly researched (29,30). The findings from Ainsworth and Bell showed that a maternally sensitive and more importantly a rapid response to the infant's needs (to promote evolutionary survival) in the first three months of life was associated with a more harmonious mother–infant relationship in the final three-month period of the first year of life (30). The provision of contact stimulation through hugging and cuddling was also found to be a significant affectionate act related to the development of secure attachment (31). Furthermore, oxytocin research has supported our understanding of the levels of affectionate contact favouring the child–mother relationship (32). The studies carried out by Ainsworth and her colleagues concur that parenting methods which favour evolutionary survival in the early latchment months of life lend support to the achievement of earlier and more secure attachment which again favours evolutionary survival.

Works for reunion

The semi-altricial human baby will work for reunion with the imprinted stimulus feature by signalling the need through the innate behaviours of crying and emotional distress designed by evolution to aid survival.

Displacement

If deprived of the stimulus feature, displacement will occur. Displacement from the mother's nipple to a decoy has been reported in many mammalian species (13). Lorenz believed that once the early newborn sensitive period of the precocious gosling was completed, the object preference was permanent and could not be changed by subsequent experience (1). Sluckin and Salzen regarded imprinting (visual for precocious birds) as a perceptual learning phenomenon in which the sensitive period is experience dependent and stabilised by the amount of experience (33). Their observation is consistent with and supports the encoding process carried out by Merkel cells in the buccal mucosa at a sensitive time. Consider the human baby fixated on a pacifier/dummy or thumb; a change of imprint back to the maternal breast may be achieved, despite great

emotional distress, by bed-sharing skin to skin with baby for a few days with mother's nipple; the only stimulus feature made available. We believe that this is not inconsistent with Sluckin's, Salzen's and Meyer's opinion (33,34). It has been observed that the unrestricted availability of the nipple in the birthing room with baby in skin to skin contact with the mother until the first breastfeed has been completed with sleep is associated with baby adopting an innate, anatomically efficient, deep latch breastfeeding skill with subsequent improved success and duration of breastfeeding (35,36). This process has similarities, such as in other species, where a precocial bird hatchling innately recognises the real mother for evolutionary survival during the sensitive period, in a natural nesting environment free of alien biological and nonbiological stimulus features.

Importantly, maternal nipple deprivation may be followed by apparent emotional confusion and frustration leading to an inappropriate replacement of mother in the mouth by a decoy thumb or pacifier/dummy. This process is best described as 'Freudian displacement', displacement being one of Freud's original defence mechanisms (17). Distress from maternal nipple deprivation may lead to displacement, with redirection of emotions, to a substitute decoy target, thereby promoting risk of maternal fragmentation. The decoy target may be observed as a displacement promoting superstimulus (37). Examples include the macropod digit of an orphaned wallaby, tail, thumb or penis in a monkey, thumb or digit pair in the human, tongue sucking in ruminants, penis sucking in pen-mate male calves and the bottom of a boat by an orphaned whale calf (13). A nonbody part decoy such as a plastic teat, pacifier or dummy may be chosen for the animal by a carer.

DISCUSSION

The importance of the latchment phase is highlighted by the emotional development which is proceeding during the first six months of life, at a time of rapid growth which notably includes baby's brain (38). Evolutionary success requires close maternal contact and frequent breastfeeds to provide nutrition for the promotion of brain metabolism and optimal growth of myelinated white matter (39,40).

The anthropologist Margaret Mead observed that in societies where there was free access to the breast with the correlate of breastfeeding success, that decoy sucking did not occur (41). In other societies, the childcare issue of sucking decoys such as pacifiers, dummies, bottle teats and thumbs together with the concept of nipple confusion has received much attention (42–45). This issue has been described as a commerciogenic problem as it is the provider of the dummy, the giver of the bottle or the depriver of the maternal nipple who as an adult is the one confused in their own understanding of infant care (45). Understanding oral tactile recognition of decoys as mother in the mouth directs attention to the mammalian norm evolved from precursors over a period of 300 million years to produce a species-specific primate milk (46). The behavioural and health risks resulting from impairment of this defining mammalian relationship deserve attention as there is considerable contrary information provided by multinational commercial interests (47).

Harlow's orphaned and isolated monkey experiments have been of great importance in understanding emotional relationships. On comparing the videos of the wire frame mother with milk and what appears to be the socially preferred cloth mother without milk, the baby monkey thumb or body part sucks throughout the experimental room and it is probably the comfort of the cloth mother material rather than emotion which is the directive. Harlow and other observers did not realise the significance of the thumb (or other decoy) probably because thumbsucking was considered a societal norm at that time (48–50).

CLINICAL APPLICATIONS OF LATCHMENT

The outcomes for mother and baby may be improved if clinicians and mothers alike become aware of the evolutionary significance of the oral tactile imprint and the outcomes of each mode of latchment. These outcomes are wide-ranging and are described below.

Optimal latchment

Optimal latchment may be facilitated by:

- Ensuring baby's close and unrestricted proximity to the breast (skin to skin contact) until well after initial latching has commenced and baby is sleeping.
- Ensuring that the mother is aware that introducing any decoy (thumb, dummy/pacifier, bottle teat, etc.) should be avoided.
- Safe co-sleeping with the infant.
- Rapid response to distressed infant.

Oral tactile imprinting and the emotional component of latchment are the forerunners of a sensitive and quickly directed response to baby's needs. Carer body contact and rapidity of response are most easily and readily provided by breastfeeding. There is evidence from observational studies that the rapidity of response to infant needs, which has over the millennia been a component directed at evolutionary success, favours secure attachment (16,29–31,51).

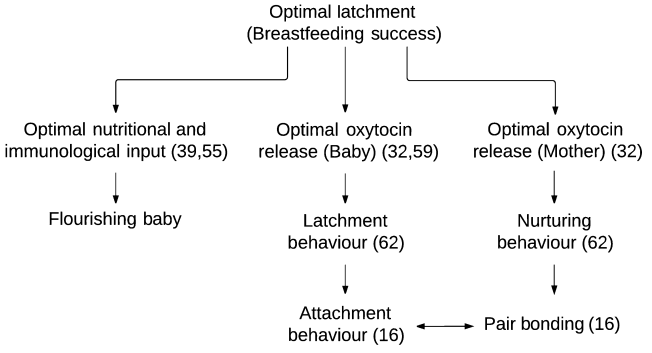

Figure 1 Physiological and psychological outcomes of optimal latchment.

Awareness of a positive relationship between latchment behaviour and attachment should be seen as a noteworthy clinical application. The physiological and psychological outcomes of optimal latchment are summarised in Figure 1.

Suboptimal latchment

Clinical practices that are inconsistent with the evolutionary process of latchment should be avoided. These include:

- A delay in the introduction of baby to the breast.
- Maternal nipple deprivation.
- Displacement with a thumb, dummy/pacifier or other decoy.
- Distancing mother and baby during sleep.

Maternal nipple deprivation may be seen in the birth room when there is failure in recognising the sensitive time heralding baby's readiness to suckle. At other times, the suckling may be restricted with insufficient time given for stabilisation of the imprint. The oral tactile imprint has evolved as a survival strategy associated with birth and the achievement of a latch to the breast for optimal milk transfer. The emotional component, termed latchment, will continue for evolutionary success. Restricted access to the breast for suckling results in stasis of milk within the breast and subsequent release of feedback inhibitors of lactation will lead to dwindling of milk production (27).

Parenting attitudes that limit physical contact with children and restrict affection by distancing have resulted in relationship deprivation at sleep time (52). The imprinted object is the one suckled (mammalian breast) or sucked (other than the mammalian breast) when baby is passaging to sleep (53). Untimely absence or planned deprivation of the maternal nipple with onset of decoy sucking is causally related to the way of falling asleep where the infant may be painfully aware of separation (54). Displacement of an oral tactile imprint is an important concept and provides a reason why decoy usage of pacifiers/dummies/thumbs as the mother hinders breastfeeding success (17,56).

Nutritional and immunological deficits together with emotional and cognitive changes which are associated with formula feeding are of concern, and continued exploration of the effects of formula feeding is vital for our understanding of this field. The physiological and psychological outcomes of displaced latchment are summarised in Figure 2.

FUTURE RESEARCH

This paper has identified and drawn together a broad range of published research supporting the hypothesis that human imprinting is an oral tactile mechanism with consequential clinical implications. Due to a paucity of relevant literature, a quantitative meta-analysis was not able to be performed. There remain areas of research that would lend further supporting evidence for the hypothesis, in particular the spontaneous and instinctual behaviours indicating readiness for latching, and secondly the transition from latchment behaviour to attachment behaviour. This future work may consider quantitative rather than qualitative methods of investigation, including newer radiological techniques such as magnetic resonance brain imaging, serological markers and precise developmental monitoring during early life.

Instinctual behaviours indicating readiness for latching

It has been observed that newborn babies proceed to open their eyes widely after birth (20) occurring about 5–20 minutes after an initial blinking phase. Following this, the mouth opens and the tongue descends and protrudes. Further research may confirm whether this transition indicates readiness to commence latching. Such a study may involve confirming the proportion and temporal association of babies that undergo this transition and a longitudinal study that measures breastfeeding success against the first imprinted object.

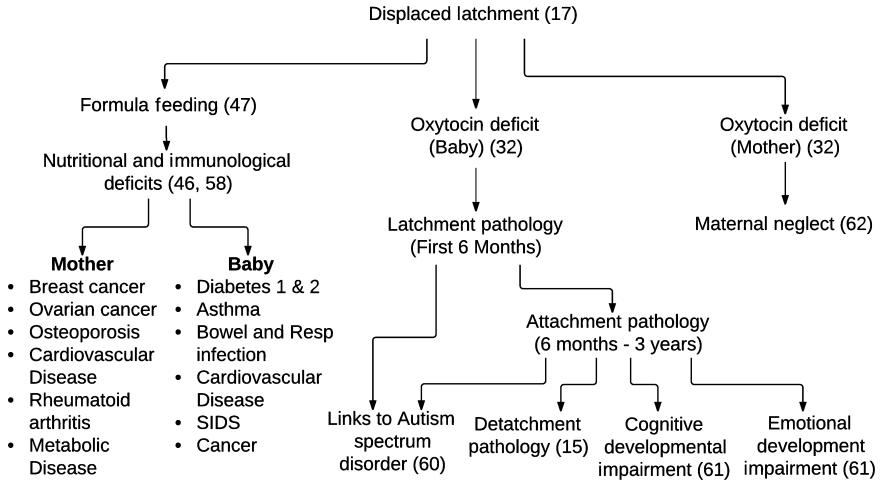

Figure 2 Physiological and psychological outcomes of displaced latchment.

Transition from latchment behaviour to attachment behaviour

It is proposed that attachment characteristic (second stage of emotional development) is largely dependent upon successful latchment (the first stage of emotional development). A longitudinal study may consider three groups of newborns involving an exclusively breastfed control as an evolutionary standard, partially breastfed group and formula-fed group to identify the correlation with the security and timing of attachment. Analysing the dose relationship of formula feeding to illness, behaviour, public health costing and management would provide a useful contribution to our further understanding in this area (57).

CONCLUSION

We have provided evidence that imprinting is a process by which babies orally fixate to a stimulus feature, normally the mother's nipple and surrounding milking area, for evolutionary survival. Imprinting is soon followed by latchment which is the first stage of emotional development in which the baby recognises its mother through oral tactile memory for continuing evolutionary success. Displacement of the normal imprint from the mother's breast may lead to a range of adverse outcomes for both mother and baby. We believe that the understanding of these processes and their evolutionary survival significance may help us to better serve and support the choice to breastfeed and the breastfeeding mother and her baby.

DISCLOSURE STATEMENT

No competing financial interests exist.

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