

The Importance of Positioning the Near-term Infant for Sleep, Play, and Development

Kara Ann Waitzman, OTR/L

The *near-term infant* (NTI) refers to the infant born between 34 and 37 weeks' gestational age. These infants may initially be cared for in well-baby nurseries, special care nurseries, or neonatal intensive care nurseries. These infants have a unique set of abilities and needs, which do not always mimic the abilities and needs of either their older term or younger, more preterm, counterparts. Health care professionals must adapt their care practices and discharge teaching to meet the unique needs of the NTI. This article will address the unique needs of the NTI with regard to neuromotor maturation, positioning, and safe sleep practices, as well as how health care professionals can alter daily care practices and discharge teaching when working with this special population.

© 2007 Elsevier Inc. All rights reserved.

Keywords: Near-term infant; Neuromotor maturation; Positioning; Back to sleep and tummy to play

In 2005, the Association of Women's Health, Obstetric and Neonatal Nurses, launched a multiyear Near-Term Infant Initiative to raise awareness of the needs of near-term infants (NTIs).¹ This campaign has addressed these infants' increased risk of hyperbilirubinemia, respiratory distress syndrome, feeding difficulties, and others. Many health care workers have overlooked these risks as the trend toward earlier discharge of patients from the hospital continues. In fact, many health care workers have looked upon these infants as "benign preemies" or small term infants, sending them home shortly after birth without special care or instructions related to their risks. However, these infants do in fact have unique characteristics and risks, not only medically, but also with regard to development.

Therefore, health care givers must be cognizant not only of how they position infants in the hospital nursery but also how they teach parents to position infants for sleep, play, and development once discharged.

Neuromotor Development

Fetal development occurs as the fetus is supported in a fluid-filled amniotic sac, which provides gravity-eliminated, cushioned support 360° around the body. As the sac provides the

fetus with boundaries to support the infant in a flexed and contained position, the brain is also promoting this predominance of flexion and midline alignment. During the last few months in utero, with the support of the central nervous system (CNS) and womb environment, the fetus develops *physiologic flexion* (Fig 1). Physiologic flexion is the strong flexor muscle tone of the extremities and the increased stretch reflexes characteristic of the typical full-term newborn. This physiologic flexor tone is responsible for the term newborn's recoil of the upper and lower extremities when traction is provided. This strong predominance of flexion is also what allows a healthy term newborn, who is positioned supine, to maintain shoulder protraction and an anterior pelvic tilt. Physiologic flexion is believed to be vital for the development of normal body movement and control.²

The degree of physiologic flexion is proportional to how long an infant is in utero. An NTI will not have strong physiologic flexion because birth occurs before this is complete. Muscle tone develops in a caudocephalad (toe to head) direction in utero. Therefore, an NTI born at 35 weeks' gestation will likely have more physiologic flexion developed in the legs than in the arms. This can be seen when an infant's legs are pulled down straight, and they spring back rapidly, but the arms pulled down straight only partially flex and are much slower to react. Even by the time the NTI reaches 40 weeks, the degree of lower and upper extremity muscle tone will not be nearly as prominent as that of the full-term infant who developed complete physiologic flexion from being in the womb the full 40 weeks.

Normal infant developmental milestones after term age occur cephalocaudal (head to toe) and require a balance of flexion and extension muscles. For example, when attempting to sit upright, if the infant has more extensor tone than flexor tone in the trunk, the infant will not be successful and may fall

From the Tipp City, OH; Neonatal Intensive Care Unit, Miami Valley Hospital, Dayton, OH; Creative Therapy Consultants, Tipp City, OH. Address correspondences to Kara Ann Waitzman, 8540 Wildcat Rd, Tipp City, OH 45371. E-mail: kwaitzman1@earthlink.net.

© 2007 Elsevier Inc. All rights reserved.

1527-3369/07/0702-0201\$10.00/0

doi:10.1053/j.nainr.2007.05.004



Fig 1. Fetus in physiologic flexion.

backwards. Because NTIs generally do not start with strong flexion, they are at risk for not developing this delicate balance. These infants benefit from positioning in the first weeks and months of life to enhance flexor tone and strength, thereby allowing the forthcoming extensor tone to be balanced. If this postural support is not provided, the NTI is not only at risk for a poor balance between flexor and extensor muscles but may also develop asymmetrical muscle tightness, both of which could lead to a delay in overall growth and development.

Effects of Positioning

Positioning an infant appropriately is one of the easiest ways to provide postural support that has both an immediate and lasting impact on an infant's development. Positioning itself is an unobtrusive intervention strategy that can be used to promote infant neurobehavioral and neuromotor stability. Inadequate positional support as well as a lack of variety in positioning can lead to a host of developmental issues. The following is a review of three of these issues.

Skeletal System

Skeletal deformities from inappropriate positioning include abnormal cranial molding leading to conditions known as positional plagiocephaly. Lateral head flattening often occurs in premature infants because of positioning that allows for consistent pressure on the sides of the head. This results in infants with long narrow heads. Flattening of the occiput (the posterior portion of the head) occurs when consistent pressure is provided during supine positioning. The flattening of the back of the head is typically asymmetrical, causing the head to tilt to one side as it rests on the flattened part of the head. The incidence of

positional plagiocephaly increased significantly when the infant sleep position in America was changed to supine to decrease the risk of sudden infant death syndrome (SIDS).^{3,4} Whereas inadequate positioning or a lack of variety in positioning can cause these cranial abnormalities, supportive positioning can virtually eliminate this problem, in the presence of an intact CNS. Caregivers of the NTI must not only provide adequate positioning in nurseries but must incorporate parental teaching of these positioning principles into their everyday practice.

Muscular System

Muscular changes from inadequate positioning or a lack of variety in positioning involves the elongation and/or shortening of muscles leading to a variety of conditions. Torticollis is one such condition that refers to the asymmetrical shortening of the sternocleidomastoid muscle (SCM). The SCMs are the thick muscular bands that attach to the skull under each ear (the mastoid) and cross diagonally down the neck to the top of the sternum. Shortening and/or elongation of this muscle occurs when an infant is positioned prone or supine with the head always to one side. For example, when the head is turned to the right, the right SCM is contracted, and the left is elongated. When this is maintained for a long period, the right SCM can become shortened, making it difficult to fully turn the head to the left. Unsupported head positioning in car seats and infant seats can also facilitate this shortening. Torticollis is often accompanied by plagiocephaly. As the head shape flattens, the head naturally falls to one side, causing the secondary condition of torticollis.

Because NTIs do not have strong flexor tone and are not able to maintain antigravity movements for long periods, they are more at risk than the term infant for these conditions. Likewise, an infant can be at greater risk for torticollis if he or she was exposed to crowding in the womb, as seen with multiples. They often become "stuck" in a corner of the womb, which allows little or no movement of body parts. Twins and other multiples are often predisposed toward positional asymmetry at birth.⁵ Once again, because many twins are born at 34 to 37 weeks, the twin NTI can have a higher predisposition toward these conditions.

Consistent unsupported prone or supine positioning can lead not only to asymmetrical tightness in the neck but also to external rotation of the shoulders, lateral rotation of the legs, and everted feet, causing acquired muscular shortening in these areas. Specifically, the posterior neck and arm muscles become shortened, whereas the anterior chest and arm muscles become elongated. Health care workers often refer to this elevated and externally rotated shoulder position as a "W" arm position. Likewise, the leg abductor muscles become shortened, and the adductor muscles become elongated in the lower extremity when placed unsupported in supine position. Health care workers often refer to this external rotation of the legs as "frog" leg positioning (Fig 2). In prone position, the surface impedes midline alignment, thereby reinforcing this same position. Muscular shortening develops rapidly when only one position is provided, which can then disrupt functional motor organization, making coordination between limbs and gaze difficult.⁶



Fig 2. Infant in W position of arms and frog position of legs. Reprinted with permission from the Good Samaritan Hospital Cincinnati, Ohio.

In addition, when an infant becomes tight with a W position and is placed prone, the infant uses posterior extensor muscles to maintain the position, instead of “pushing up” on arms. This becomes both nonfunctional and uncomfortable for the infant, which leads to irritability and crying.⁷ Parents often change their infant's position back to supine when this occurs. Infants then spend very little time in the prone position and develop a weakness of the upper body muscles, making it difficult to push up in prone position, which then impedes normal milestones. This muscular weakness and shortening can alter the typical motor milestone of rolling prone to supine at 4 months and prop sitting at 6 months. In fact, slight delays in development are noted in creeping, crawling, and pulling to stand when infants are primarily placed supine.⁸ This illustrates yet another example of how positioning can alter development.

Infants require a sensorimotor feedback to learn and explore their environment. In prone position, infants easily discover their hands and have their whole body in contact with the surface, providing sensory feedback through their hands, face, and other body areas. The infant can easily suckle on his or her fists and is exposed to a lot of tactile sensory input to the face and mouth when prone. This oral and visual exploration of the hands is certainly facilitated with side-lying positioning. This sensory input is the foundation for later sensory input. It is interesting to speculate what the lack of this sensory input does to overall sensorimotor development for infants who are not provided with prone or side-lying positions for self-exploration. Feedback of normal posture and movement is essential to the development of normal motor control.⁹ Delays in reaching motor milestones, abnormal movement patterns, as well as impacted play skills are all influenced by positioning.¹⁰

Behavioral Organization

Supportive positioning can provide stability not only of an infant's sensorimotor system but also their behavior and state system. Appropriate positioning can promote neurobe-

havioral organization, keeping the baby calmer and easier to care for.¹¹

Contrary to the term infant, the NTI does not have full capacity of state arousal until after 36 weeks and does not have consistent periods of focused alertness until after 37 weeks.⁹ Preterm infants spend about 80% of their sleep time in a more disorganized state of light sleep compared with full-term infants, who spend about 50% of overall sleep time in either light or deep sleep.⁹

Caregivers of these NTIs often become frustrated when laying their unsupported NTIs supine to sleep because the infant becomes frantic and has difficulty achieving a deep sleep. Likewise, the caregiver may try to feed the infant in an unsupported position and find the infant unable to maintain alertness to complete the feed. However, if the caregiver provides positional support, such as proper swaddling, he or she can help the infant be more successful with these activities. Therefore, by providing appropriate supportive positioning, we can decrease energy expenditure and improve behavioral organization, which can affect overall growth and development.

Developmental Implications of the Back to Sleep Program

The impact of positioning on the development of the healthy newborn has been more readily seen since the initiation of the Back to Sleep campaign. The American Academy of Pediatrics (AAP) initiated the Back to Sleep program in 1994 to increase public awareness of the growing research to support

Table 1. Synopsis of AAP 2005 SIDS Recommendations

1. Infants should be placed supine (wholly on their backs) to sleep. Side lying is no longer recommended for safe sleep.
2. Infants should be placed on a firm sleep surface with only a sheet to cover the mattress.
3. No loose bedding or other soft objects should be within the bed/crib.
4. Prenatal smoking should be eliminated as well as infant's exposure to second-hand smoke.
5. Infants should sleep alone in a crib, bassinet, or cradle in an area proximate to their caregiver.
6. A clean pacifier may be offered at nap time and bedtime. This may be delayed 1 month if breastfeeding.
7. Avoid overbundling to reduce overheating.
8. Avoid commercially available positioning devices.
9. Do not rely on home monitors as a prevention of SIDS.
10. Avoid positioning plagiocephaly by encouraging tummy time, altering head position, and referring to early intervention when warranted.
11. Encourage all caregivers of infants to follow established guidelines for SIDS prevention.

Adapted from the American Academy of Pediatrics, Task Force on Infant Sleep Position and Sudden Infant Death Syndrome.¹²

that nonprone sleep position decreases an infant's risk for SIDS. The initial recommendations from AAP for nonprone sleep began in 1992. Since that time, the AAP has continued to alter recommendations based on research findings. Some of the latest recommendations state that infants should sleep on a firm mattress in a crib with no soft materials and extra bedding. A more complete list of the 2005 recommendations from the AAP Task Force on Sudden Infant Death Syndrome is provided in Table 1. A comprehensive list and future recommendations can be found at www.aap.org by typing in "SIDS recommendations" in the search area. The main theme of the November 2005 recommendations, however, is to ensure that parents place their infants wholly on their backs to sleep, vs the traditional prone position that was prominent before 1992 and side-lying position that is still prevalent today. The program has been overwhelmingly successful, with the incidence of SIDS decreasing by approximately 50% since 1992.¹²

With the increase in supine sleeping since the advent of the Back to Sleep program, infants are developing plagiocephaly and torticollis more readily. Other effects of supine positioning that have been noted since the initiation of the Back to Sleep program are changes in the musculoskeletal development and achievement of developmental milestones. These delays are not of concern, when compared with the risk of survival noted with nonprone sleep. Nonetheless, in light of the increase in infant developmental delay requiring therapeutic and/or early childhood intervention, the AAP revised their position statement in March 2000 to include a strong recommendation for an infant to spend time prone when awake and supervised. The 2005 recommendations continue to support this because the evidence of musculoskeletal tightness, plagiocephaly, and delayed development are still concerns noted with exclusive supine lying. Therefore, all health care workers must educate the lay public on the importance of **Back to Sleep and Tummy to Play**. Both deformational plagiocephaly and musculoskeletal changes causing gross motor delays can be significantly reduced with education of the family to provide their infant with prone time (tummy time) while awake or accompanied by an adult.

Implementing Back to Sleep and Tummy to Play

"Back to sleep" and "tummy to play" should be encouraged within the first few days of life and continued thereafter. Parents should be educated not only on the risk of SIDS, and the accompanied recommendations related to nonprone sleep, bedding, and not smoking, but also on the risk of altered development if tummy time is not provided. Being prone while awake or with an adult allows the infant the opportunity to develop the balance of flexion and extension needed for normal musculoskeletal development and normal sensory exploration and self-calming, as described earlier. Likewise, tummy to play, also referred to as *tummy time* or *prone play*, allows an opportunity for normal posterior head molding, thereby reducing the risk of plagiocephaly. Health care givers must

Table 2. Benefits of Proper Positioning

- Facilitate normal patterns for growth and development
- Prevent muscle tightness and asymmetry
- Decrease unnecessary energy expenditure and stress
- Provide sense of security and boundaries for individualized containment
- Enhance infant self-regulation and physiologic stability
- Facilitate self-calming behaviors and aid in infant organizational ability
- Improve head shaping and decrease cosmetic deformity
- Provide sensory exploration of self and environment

teach parents and emphasize compliance with tummy-to-play activities when addressing back-to-sleep concerns.

Benefits of Proper Positioning

Proper positioning of an infant can be accomplished with four principles in mind: the infant should be *flexed, contained, aligned, and comfortable*. When these principles are achieved, normal musculoskeletal development is more likely to occur, which can lead to more normal cognitive and social development as well. Table 2 outlines more specific benefits of proper positioning.

The position an infant is placed in can be used as a cue to the infant of the upcoming activity. For example, it is typical of an infant who has been breastfeeding to begin rooting to eat when placed in the familiar side-lying position of feeding across the mom's chest. In a similar manner, when supine position is consistently used for sleeping, and prone position is used for playing, the infant can begin to associate these positions with activities and sleep-wake cycles. Allowing the NTI time in prone, supine, and side-lying positions offers the infant optimal musculoskeletal development.

Putting It Into Practice

Whether the health care professional cares for NTIs in the hospital's well-baby nursery, special care nursery (SCN), neonatal intensive care nursery (NICU), or in an outpatient physician's office setting, the education on proper positioning for both safe sleep and normal development is critical.

One quick and easy way to assure an infant is provided with flexion, containment, alignment, and comfort is by swaddling him or her in a blanket. Swaddling can also be used as an adjunct to infant pain management, is a means of neutral warmth for relaxation, and can provide a reduction of extraneous movements for decreased energy expenditure.⁸ When swaddling, care should be given to assure that the infant's pelvis is softly flexed, allowing the infant's knees to approximate to the abdomen. Shoulders should be rounded forward with hands brought to midline, allowing hand-to-hand or hand-to-mouth self-calming behaviors. Hand swaddling, also known as a facilitative tuck, can be done with smaller NTIs, who may be in the NICU or SCN (Fig 3). When a blanket is used, the blanket

