Predictability of Neonatal Sucking for Later Developmental Outcomes

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As early as 1974, it was reported that a deviant suck was a sign of neurological issues.[1] Hill and Volpe reported in 1981 that, difficulty with neonatal sucking has been described as an early indicator of neurologic abnormalities.[1] Typical sucking in the infant has been well described in the literature. It is generally accepted that, in the preterm infant, the immature pattern is characterized by short bursts of three to five sucks followed by a pause of equal duration. In the term infant, there is a continuous sucking burst of 10-30 sucks per burst with an average ratio of one suck-one swallow-one breath.[2] In both cases, the infant is comfortable with coordinated respiration while feeding occurs effortlessly.

When an infant is unable to coordinate sucking, swallowing, and breathing in a rhythmical and comfortable fashion, the suck pattern presents as disorganized.[3] In this case it is usually caused by the infant's inability to maintain adequate respiration while also sucking and swallowing. Such infants may experience apnea or oxygen desaturation during feeding.[4] If feeding persists, the infant may show signs of stress such as finger splay, head turning, widening of the eyes, extension of the limbs, arching backward, or any of the many other behaviors indicative of distress. It is important for the feeder to recognize these signs of stress in the infant, to respond quickly to alleviate the cause of stress which will calm the infant, and to assure feeding is a pleasurable experience.[5]

The Neonatal Oral Motor Assessment Scale (NOMAS) is a tool designed to assess neonatal sucking and distinguish between disorganized and dysfunctional feeding. A recent study reported that infants who lack coordination of suck-swallow-breathe and who also experience stress during feeding, as based on the NOMAS, have a longer transition time to full oral feedings than those infants who are not stressed during feeding. Infants with a disorganized suck who are stressed take 22 days to transition to full oral feedings, while those with no stress can transition in six days.[6]

Dr. Xianhong Zhang and colleagues in the Department of Neonatology at the Children's Hospital of Chongqing Medical University in Chongqing, China used the NOMAS to identify abnormal sucking patterns in moderately and late preterm infants and to ascertain the relationship between these patterns and neurodevelopmental outcome at six months corrected age. This study did not enroll infants with neurologic disorders, so no infants were classified as having a dysfunctional suck. Infant feeding was classified as either normal or disorganized based on the NOMAS. The researchers reported that infants who demonstrated stress signs per the NOMAS, that is, incoordination of suck, swallow, and respiration which result in nasal flaring, head turning, and extraneous movement, along with arhythmical jaw and tongue movements, were at risk for adverse neurodevelopmental outcomes at six months corrected age.[7]

In addition to infants who present with both a disorganized suck and stress per the NOMAS, it is also possible to predict later developmental outcomes for infants who present with a dysfunctional suck.[8] This suck pattern can be identified by abnormal movements of the tongue and jaw that occur during active sucking and that are never typical. These movements include the lack of a central tongue groove compared to a cupped tongue with a central tongue groove. The tongue instead presents as either flattened/flaccid with an absent tongue groove or is retracted with the posterior tongue humped against the palate.[8] During a dysfunctional suck, the jaw may demonstrate an excessively wide excursion pulling the tongue away from the nipple and interrupting the intra-oral seal that is formed between the tongue and the palate. Another characteristic of a dysfunctional suck occurs when the jaw is unable to make an adequate downward movement due to a restriction of movement at the temporal-mandibular joint that inhibits smooth downward movement of the jaw. This restriction is secondary to the posterior humping of the tongue against the palate. In all cases when a dysfunctional suck is diagnosed, there is a neurological issue that has been identified or soon will be identified.[9] These may include diagnoses such as, grade III intraventricular hemorrhage (IVH),[9] periventricular leukomalacia (PVL), perinatal hypoxic ischemic encephalopathy (HIE), seizure disorder, hydrocephalus, meconium aspiration, meconium staining, congenital anomalies, placenta abruptio with decreased muscle tone, chromosomal abnormalities, and neonatal encephalopathy of unknown etiology, to name a few. It has been reported that in addition to an association with dysfunctional sucking, severe IVH negatively impacts the suck-swallow-breathe rhythm. The independent effect of neurological injury in the form of IVH on early neonatal feeding coordination suggests that a closer analysis of feeding may reflect and predict neurological sequelae.[9]

Early diagnosis of the neonatal suck pattern is important because of the complexity of the neuronal network needed to suck and neuroplasticity in infancy. Because of this, the skill of sucking has the unique ability to give insight into areas of the brain that may be damaged either during or before birth.[10] In 2009, it was hypothesized that a standardized instrument

for neonatal sucking could offer a cost-effective early screening tool for preterm infants at greatest risk for developmental delay,[11] and the NOMAS provides such a tool. The NOMAS can be administered at the bedside within two to three minutes by the trained examiner observing a routine feeding offered by the assigned caregiver in the intensive or special care nursery. The examiner first observes the non-nutritive suck during the first burst, first pause, and second burst to rule out sensory conditions such as habituation and perseveration. This is followed by a two-minute observation of nutritive sucking starting once the nipple is adequately and properly placed in the infant's mouth. The number of sucks per burst and the type of pattern (continuous or burst-pause) is observed and recorded. A disorganized sucking pattern occurs when an infant exhibits too much variability in the number of sucks per burst (sucking bursts have between 5-10 sucks per burst), or the infant demonstrates an inconsistent suck-swallow-breathe ratio. The NOMAS may also be used for breast feeding infants but will require the examiner to spend more time observing the infant because of the variability of flow that occurs with breast feeding.[12,13]

NOMAS-based assessments for neonatal feeding performance have been considered helpful tools to predict neurodevelopmental outcome at six and 12 months corrected age.[14] The NOMAS has been identified as the only neurobehavioral assessment that specifically measures preterm sucking behavior.[15] Slattery reports in a review article that, early sucking and swallowing measures predicted neurodevelopmental outcome in later infancy in five of the six studies reviewed.[16] Thus studies show that sucking and swallowing disorders in early infancy serve as potential markers of neurodevelopmental problems and abnormal sucking patterns may reflect neurologic developmental issues in preterm infants.[17]

The NOMAS provides predictability for later developmental outcomes for both disorganized and dysfunctional sucking patterns and is a screening tool that can be administered by observation at the bedside by a trained examiner. Trained examiners demonstrate reliability in the administration and scoring of the NOMAS to distinguish between disorganized and dysfunctional sucking patterns to assure the subsequent intervention strategies, therapeutic techniques, and treatment plans are appropriate. Currently there are NOMAS Licensed Professionals in 46 U.S. States and 40 foreign countries.

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