Can Autistic Spectrum Disorder (ASD) Be Predicted From Early Reflexive Sucking?

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Prior to the first publication of the NOMAS® (Neonatal Oral-Motor Assessment Scale) in 1985, preterm infants and sick term infants in the NICU (Neonatal Intensive Care Unit) were described as "poor feeders" or "good feeders." The poor feeders all received the same intervention strategies to improve their feeding, i.e., chin support, cheek support, and manual expression of the liquid into the mouth by the caregiver. In addition, the theory was that all premature infants were hypotonic and therefore, oral feeding was much more work for them. Consequently, the formula companies manufactured a very soft, fast flow nipple (teat) for these infants so they would find it easier to be successful at oral feeding. This hypothesis unfortunately was incorrect, and it was later demonstrated by the NOMAS® that these premature infants were unable to coordinate sucking/swallowing and breathing because they did not yet have the neurological maturation or the respiratory support to do so. Transferring more liquid into their mouth only made their effort to breathe that much harder. It has now been reported that infants who present with a disorganized suck and stress on the NOMAS® require 22 days longer to transition to full oral feeds than those infants who present with a disorganized suck based on the NOMAS®.[1] Stress signs have been well documented by Developmental Specialists, who are trained to recognize them, and many times they are caused by the infant's inability to coordinate suck/swallow with respiration. Coordination of the pharyngeal swallow with respiration is required for successful and normal nutritive sucking. Stress may also be caused by esophageal dysmotility, constipation, allergies, and several other issues.

The NOMAS® was designed to evaluate and diagnose the reflexive infant suck pattern as normal, disorganized, or dysfunctional. It has been reported that when an infant presents with a dysfunctional suck on the NOMAS he/she has a developmental delay in one or more areas by two years of age.[2] These infants may be able to coordinate respiration with suck and swallow but demonstrate abnormal movements of the tongue and jaw during sucking.

Using the NOMAS®[3] (Figure 1), the trained professional examiner is also able to observe and diagnose such sensory processing disorders as habituation, perseveration, and poor adaptability in the newborn who demonstrates a reflexive non-nutritive (NNS) and nutritive (NS) suck pattern. It has been reported that the normal non-nutritive suck is a burst/pause pattern consisting of 5-20 sucks lasting less than seven seconds.[4] It is anticipated, therefore, that after the first pause the infant will re-initiate the second burst. When an infant demonstrates habituation there will be a NNS pause after which the infant will cease to re-initiate the second sucking burst unless a new stimulus is provided, such as: twisting, turning, pulling the nipple: stroking the head: moving the body, etc. Caregivers often kindly report that these infants "forgot the pacifier is in the mouth so you need to remind them". So, when the first NNS burst, the first NNS pause, and the second NNS burst are observed, this sensory processing disorder can be ruled out. If an infant is transitioning to a lower state which has caused them to stop sucking on the pacifier most likely the provision of a new stimulus would be less successful. Frequently during bottle feeding, preterm infants may stop sucking. Much of the time this is for breathing but, when the infant fails to re-initiate the sucking activity after a reasonable amount of time, habituation may be suspected. Habituation may be confirmed when the introduction of a novel stimulus results in a re-initiation of the suck. If an infant has become fatigued and is transitioning into a sleep state, the new stimulus would be less effective. The caregiver may assume that the infant requires the introduction of a novel stimulus to re-initiate the suck, but should proceed with caution in case the infant has just paused to breathe. Interrupting respiration during feeding is inadvisable.

It has been reported that when an infant presents with a dysfunctional suck on the NOMAS he/she has a developmental delay in one or more areas by two years of age.

Habituation has a place in normal infant development and is referred to as "sensory integration". An example of this would be that the first time a sleeping infant hears the vacuum cleaner

Figure 1: Neonatal Oral-Motor Assessment Scale (NOMAS)

NOMAS ®

Neonatal Oral-Motor Assessment Scale (NOMAS)

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Jaw		
Normal	Disorganization	Dysfunction
— consistent degree of jaw depression	— inconsistent degree of jaw depression	— excessively wide excursion that interrupt the intra-oral seal on the nipple
— rhythmical excursions	— arrhythmical jaw movements	— minimal excursion; clenching
— spontaneous jaw excursions occur upon tactile presentation of the nipple up to 30 minutes prior to a feed	— difficulty initiating movements: • inability to latch on • small, tremor-like start-up movements noted • does not respond to initial cue of nipple until jiggled	— asymmetry; lateral jaw deviation
— jaw movement occurs at the rate of approximately one per second (1/2 the rate of NNS)	— persistence of immature suck pattern beyond appropriate age under 40 weeks PC (transitional suck)	— absence of movement (% of time)
— sufficient closure on the nipple during the expression phase to express fluid from the nipple		— lack of rate change between NNS and NS (NNS =2/sec; NS=1/sec)
Tongue		
Normal	Disorganization	Dysfunction
— cupped tongue configuration (tongue groove) maintained during sucking	— excessive protrusion beyond labial border during extension phase of sucking without interrupting sucking rhythm	— flaccid; flattened with absent tongue groove
— extension-elevation-retraction movements occur in anterior-posterior direction	— arrhythmical movements	— retracted; humped and pulled back into oro-pharynx
— rhythmical movements	— unable to sustain suckle pattern for two minutes due to: • habituation • poor respiration • fatigue	— asymmetry; lateral tongue deviation
— movements occur at the rate of one per second	— incoordination of suck/swallow and respiration which results in nasal flaring, head turning, extraneous movement	— excessive protrusion beyond labial border before/after nipple insertion with out/down movement
— liquid is sucked efficiently into the oro-pharynx for swallow		— absence of movement (% of time)

Summary and impression:

Recommendations:

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they wake up crying; the second time they just stir in the crib; and by the third time sleeps through the stimulus. However, habituation to a nipple (teat) that is providing nutrition is never part of normal development and should not override the reflexive suck. Sensory integration is a framework that was conceptualized by Dr. A. Jean Ayers, Ph.D. in the 1970's and she reported that a "lack of sensory integration may be one of the underlying causes of the behavioral problems in children with autism."[5] Between 90-95% of children with autism are estimated to have sensory integration/processing difficulties.[6]

Perseveration is noted when the infant sucks on the pacifier continuously using the NNS sucking rate of two sucks/second without a pause.[7] In this case, the caregiver may kindly report "they are very hungry and trying to get milk out of the pacifier." Perseveration is an indication of a sensory processing disorder and is an abnormal response. During bottle feeding there are a number of preterm and sick term infants who are unable to stop their mouth from sucking in order to breathe. Some infants may even demonstrate over 150 sucks in the two-minute sucking sample required for the NOMAS® evaluation. Perseveration during nutritive sucking may put the infant at risk for aspiration and should be carefully diagnosed, monitored, and treated.

Another indication of a sensory processing disorder that can be identified by using the NOMAS® is poor adaptability. This refers to those infants who are unable to transition easily from one nipple (teat) to another; one caregiver to another; or are unable to change positions or formula. This inability to transition is linked to the sensory system and infrequently observed in those infants whose sensory systems are within normal limits.[8] An infant may demonstrate a normal suck, based on the NOMAS® on one nipple, but a disorganized suck, based on the NOMAS® when the nipple (teat) is changed. Also, an infant may demonstrate a normal suck pattern with one type of formula, but when a different formula is offered, using the same nipple (teat) may demonstrate a disorganized suck.[9]

When the intra-oral sensory perception of the infant is severely impaired, the infant may be unable to differentiate between the NNS and NS and may fail to suck/second when the bottle is introduced. This infant may actually be transferring liquid but has no intra-oral sensory awareness of this. Infants such as these are also at risk for aspiration and attempts at oral feeding should proceed with caution.

Since habituation and perseveration have been defined in the literature as hypo- and hyperreactivity, prognostic symptoms of a sensory processing disorder, it is quite possible that, a professional who feeds infants in the NICU and who is trained in the Administration and Scoring of the NOMAS® would be able to diagnose these signs of a sensory processing disorder for infants prior to discharge.

Sensory processing disorders/sensory integrative dysfunction has been described in infants with autism who display differences in their sensory reactivity to caregiving, which is indicative of an inability to organize sensory input.[10] Autism is strongly associated with sensory processing difficulties, i.e., the ability to receive, organize, and interpret sensory stimuli, including but not limited to visual, tactile, vestibular, and auditory experiences.[11] Sensory impairments are a core characteristic of the neurobiology of Autistic Spectrum Disorder (ASD).[12]

These infants may demonstrate sensory hypo- or hyperreactivity.[13] Such responses may be manifested as perseveration which is the occurrence of repetitive behaviors[14] or by habituation which refers to the progressive decrease of the frequency of a motor response to repeated sensory stimulation.[15]

The brain undergoes faster structural and functional maturation from birth to three months than at any other postnatal developmental window, as well as significant integration across functional domains. Research on infants under six months of age who may be predisposed to developing ASD later has primarily focused on the visual area, attention to objects and faces, and overall attention. It has been stated that primitive reflexes showed no differences for infants with ASD at this age (one month), with the primitive oral reflexes excluded from the analysis.[16]

Birth before 32 weeks gestation is associated with anincreased risk of ASD.[12] Although the Center for Disease Control and Prevention (CDC) note that a baby can show signs of ASD at nine months of age, the Autistic Science Foundation states that early signs of ASD may appear in babies as young as two months of age. This newer evidence indicates that ASD can be diagnosed during infancy.[12]

Currently the NOMAS® is used by trained professionals in NICUs in 46 states of the United States of America and 40 countries around the world. A follow-up study is necessary and is long overdue to determine whether infants who demonstrate sensory processing disorders during sucking, based on the NOMAS®, are subsequently diagnosed with Autistic Spectrum Disorder.

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