Assessment of Neonatal Sucking Patterns: Normal, Disorganized, and Dysfunctional

Day 1 of the NOMAS® Certification Course

Presented by Marjorie Meyer Palmer, M.A.
Speech Pathologist
NOMAS® Instructor

Goals and Objectives:

At the end of this one day presentation the participant will:

1) Describe the anatomy and physiology of the oral mechanism in the term infant;

2) Explain the changing anatomy and physiology of the oral mechanism from birth to six months and its impact on oral feeding development;

3) Outline the relationship between non-nutritive and nutritive sucking;

4) Differentiate the oral-motor characteristics of the disorganized from the dysfunctional nutritive suck in the neonate.

Developmental Readiness to Feed:
Anatomic and Physiologic Considerations

Presented by **Marjorie Meyer Palmer, M.A.**
Neonatal and Pediatric Feeding Specialist

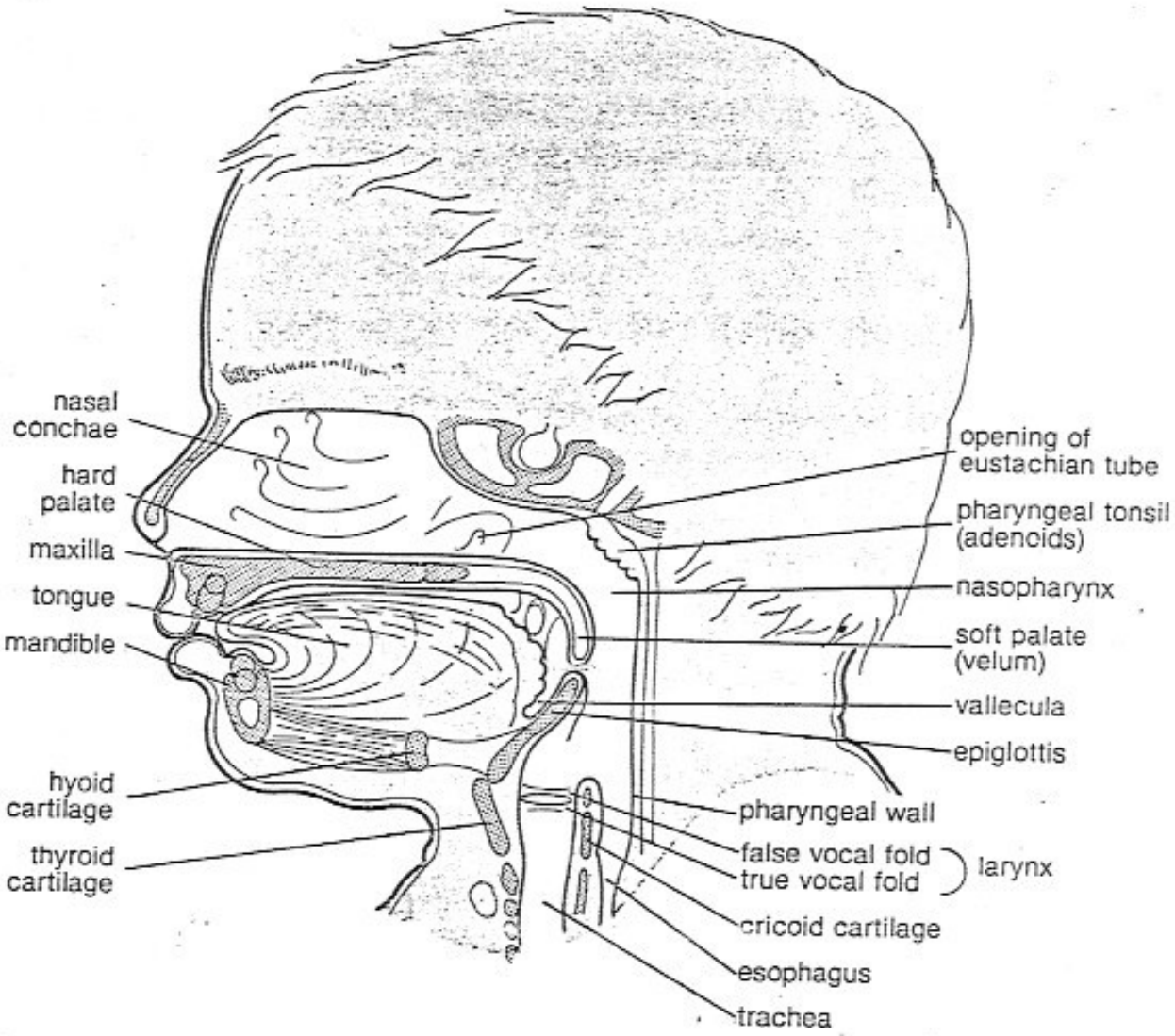
Emergence of Primitive Oral Reflexes:

- Gag reflex – 32 weeks
- Rooting reaction – mouth opening at 32 weeks; sequence of four closer to term
- Transverse tongue reflex – 28 weeks
- Phasic bite – 28 weeks
- Non-nutritive suck – in utero
- Nutritive suck – immature pattern; mature pattern

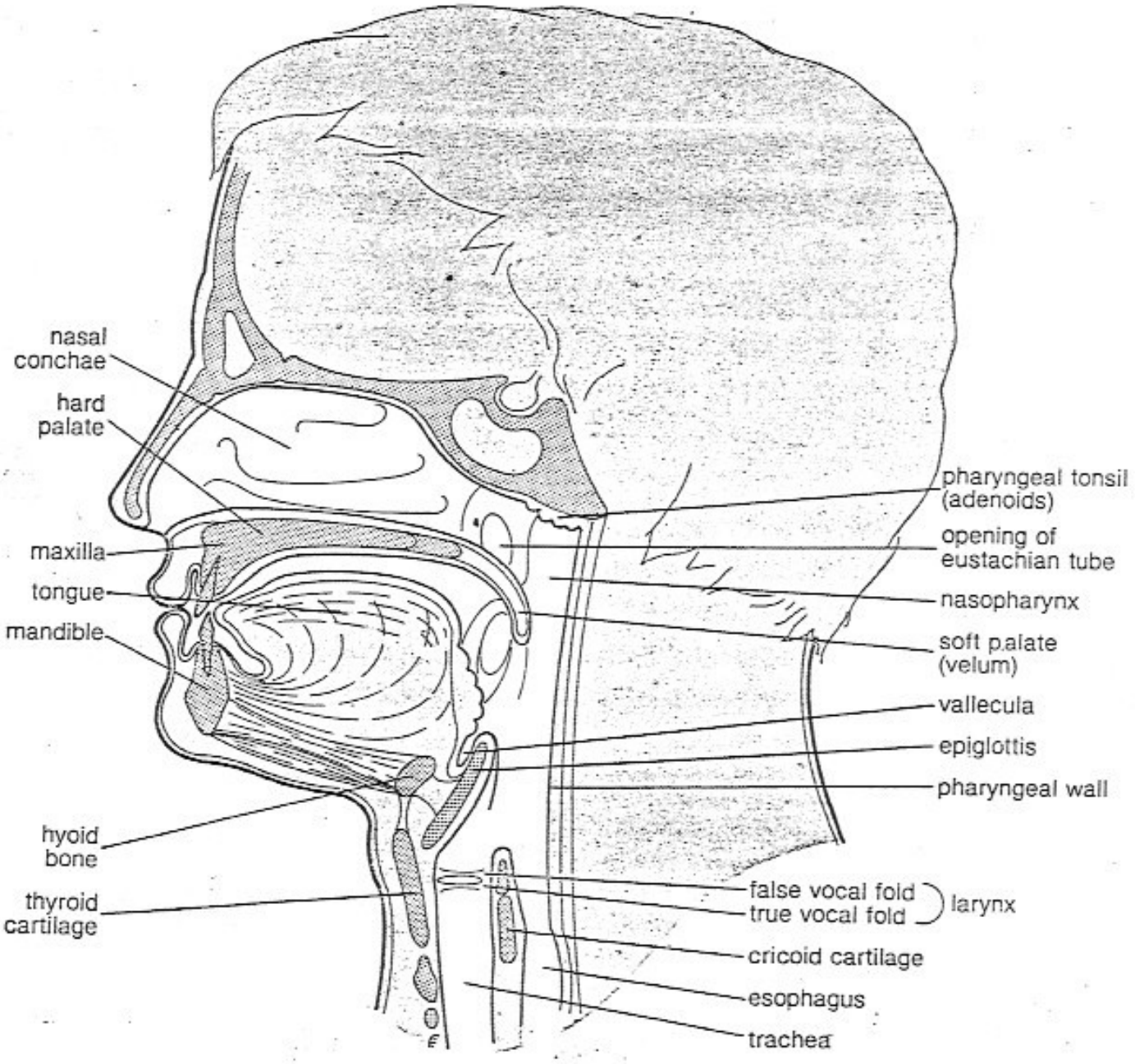
3-6 Months

- Volitional suck
- Bilabial closure
- Tongue tip elevation
- Quiet jaw

THE MOUTH AND PHARYNX OF THE NEWBORN
(saggital section)



THE MOUTH AND PHARYNX OF THE ADULT
(saggital section)



Anatomy and Physiology of the Infant Oral and Pharyngeal Mechanism

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Compiled by Marjorie Meyer Palmer, M.A.

Diagnosis of Disorganized and Dysfunctional Suck Patterns in the Neonate Based upon the NOMAS®

Disorganized

Definition: "the lack of rhythm of the total sucking activity" Crook, 1979

Characteristics: Arrythmical suck:

-Too much variability in the number of sucks/burst
-Transitional
-Inconsistent suck/swallow/breathe ratio

Dysfunction

Definition: "the interruption of the successful sucking activity by abnormal movements of the tongue and jaw" Palmer, 1983

Characteristics:

-excessively wide excursions of the jaw
-Minimal excursions; clenching
-Flaccid tongue with absent tongue groove
-Retracted tongue with posterior humping

NOMAS® ONLINE: Day 1

Neonatal Oral-Motor Assessment Scale (NOMAS)

JAW		
Normal	Disorganization	Dysfunction
_____ Consistent degree of jaw depression _____ Rhythmical excursions _____ Spontaneous jaw excursions occur upon tactile presentation of the nipple up to 30 minutes prior to a feed _____ Jaw movement occurs at the rate of approximately one per second (1/2 the rate of NNS) _____ Sufficient closure on the nipple during the expression phase to express fluid from the nipple	_____ Inconsistent degree of jaw depression _____ Arrhythmical jaw movements _____ Difficulty initiating movements: ___ Inability to latch on ___Small, tremor-like start-up movements noted ___ Does not respond to initial cue of nipple until jiggled _____ Persistence of immature suck pattern beyond appropriate age ___Under 40 weeks PC (transitional suck)	_____ Excessively wide excursions that interrupt the intra-oral seal on the nipple _____ Minimal excursions; clenching _____ Asymmetry; lateral jaw deviation _____ Absence of movement (% of time) _____ 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 _____ Extension-elevation-retraction movements occur in anterior-posterior direction _____ Rhythmical movements _____ Movements occur at the rate of one per second _____ Liquid is sucked efficiently into the oro-pharynx for swalllow	_____ Excessive protrusion beyond labial border during extension phase of sucking without interrupting sucking rhythm _____ Arrhythmical movements _____ Unable to sustain suckle pattern for two minutes due to: ___ Habituation ___ Poor Respiration ___ Fatigue _____ Incoordination of suck/swallow and respiration which results in nasal flaring, head turning, extraneous movement	_____ Flaccid; flattened with absent tongue groove _____ Retracted; humped and pulled back into oro-pharynx _____ Asymmetry; lateral tongue deviation _____ Excessive protrusion beyond labial border before/after nipple insertion with our/down movement _____ Absence of movement (% of time)

Evaluation of Neonatal Sucking and Swallowing

Presented by Marjorie Meyer Palmer, M.A.
Speech Pathologist
Neonatal and Pediatric Feeding Specialist

What you should know about the Nutritive Suck

- swallowing emerges in utero at 13 weeks gestation
- sucking emerges in utero at 18 weeks gestation
- coordination of suck and swallow develops at 32 to 34 weeks gestation or PCA
- coordination of suck, swallow, and breathing occurs at 37 weeks gestation or later
- deglutition apnea episodes reduce as infants mature
- maturation is related to developmental age (gestation) rather than feeding experience
- episodes of deglutition apnea remained more frequent in preterm infants reaching term compared to term infants
- there is a decrease in ventilation during sucking which improves with maturation
- sucking activity is a reflection of increased neurologic maturation in preterm infants
- preterm infants often have difficulty in coordinating the demands of suckle feeding and ventilation
- optimal suckle feeding should logically occur when a regular relationship/coordination exists between pharyngeal swallow and respiration
- non-nutritive sucking has no effect on nutritive suck

"International Congress of Pediatrics 2013" (ICP); 27th Congress of the International Pediatric Association; Melbourne, Australia, August 24, 2013.

H. Yin and C. Zhang, Children's Hospital of Chongqing Medical University, Chongquing, China

Poster Session 2.

Methods: 91 preterm infants of 30-36 weeks PMA were assessed. A video recording was made for these infants (Palmer Method) during the first two minutes of nutritive sucking and assessed by two NOMAS® assessors.

Results: The NOMAS has acceptable internal consistency for less than 35 weeks PMA. Moderate correlation was found between scores on the NOMAS® and feeding performance for less than 35 weeks PMA. The NOMAS® scores for evaluation at 30 seconds and two minutes were not consistent. The former scores were higher.

Conclusion: The reliability of the NOMAS® was acceptable in assessing the oral-motor function of preterm infants for less than 35 weeks PMA. We suggest that he evaluation time of NOMAS® was suitable for 2 minutes.

Palmer Comments: These findings indicate how difficult it is for the preterm infant to feed for even two minutes. Think about the length of time most infants are fed in the NICU. Skill levels for sucking deteriorate quickly in this population which is why we limit the time for NOMAS® assessment. The NOMAS® was designed to evaluate the infant's potential, i.e., best performance.

"Early Sucking and Swallowing Problems as Predictors of Neurodevelopmental Outcome in Children with Neonatal Brain Injury: a Systematic Review"

Slattery J., Morgan, A., and Douglas, J.
Developmental Medicine and Child Neurology, 54 2012, p. 796-806.

The main aims of this systematic review were: 1) to describe the concurrent relation of early sucking and swallowing outcomes associated with neonatal brain injury and 2) to evaluate the predictive relationship between early sucking and swallowing measures and later neurodevelopmental outcomes in this population.

Nine studies relevant to these two aims were identified through systematic searching of the literature published from 1980 to May 2011.

"….instrumental measures of early sucking and swallowing functions reported high sensitivity and specificity in terms of predicting later developmental outcomes, these tools are not accessible to all and are not routinely used in neonatal units. The NOMAS® could arguable be used more readily in clinical practice, het the user must obtain the necessary certification and training"

"the psychometric properties of the NOMAS® continue to be debated"….and further validation of the components of the NOMAS® that identify infants with neurological abnormalities is needed.

Palmer Comments: Unfortunately those professionals who have published articles which question the predictive value of the NOMAS® are either not trained in the administration and scoring of the NOMAS® or have not achieved reliability.

NOMAS®

(Neonatal Oral-Motor Assessment Scale)

developed by Marjorie Meyer Palmer, M.A.

*Administration**

Follow these steps to evaluation of sucking patterns:

1. Spontaneous initiation of suck

2. Rate Change

3. Type of Pattern
   - Immature (normal)
   - Transitional (disorganized)
   - Mature (normal or disorganized)
   - No pattern=too much variability in # of sucks/burst

4. Consistent/inconsistent Degree of Jaw Depression

5. Expression/Suction

6. Direction of Tongue Movement

7. Tongue Configuration

**This form is to be used by participants of the NOMAS® Certification Course ONLY and may not be copied under any circumstances*

NOMAS® ONLINE: Day 1

Neonatal Oral-Motor Assessment Scale (NOMAS)

JAW		
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NOMAS® ONLINE: Day 1 (Neonatal Oral-Motor Assessment Scale) Reference List: updated 10/17

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Listed in the Section on Pediatrics in the List of Assessment Tools at www.pediatricapta.org/pdfs/assessscreentools 2.pdf

Sucking variations in breast and bottle feeding
During Normal Nutritive Sucking

Faculty: Marjorie Meyer Palmer

Bottle	Breast
-spontaneous initiation of NS	-delayed initiation of NS
-consistent suck/swallow/breathe ratio	-often inconsistent suck/swallow/breathe ratio
-limited variability in the number of sucks per burst	-wide variability in number of sucks per burst
-NNS does not occur during NS	-NNS occurs intermittently during NS
-two-minute sucking sample in 2 mins.	-two-minute sucking sample takes more than two mins.
-jaw clonus as a sign of disorganization	-frequent jaw clonus
-greater posterior tongue elevation on ultrasound	-more anterior/posterior stripping action on ultra-sound

A Comparison of Bottle and Breast Feeding in the Neonate

Compiled by Marjorie Meyer Palmer

	Bottle	**Breast**
	<u>Disorganized Suck</u>	
Evaluation:		
	# of sucks per burst	in-coordination of
	suck/swallow/breathe	suck/swallow/breathe
	Ratio	
Treatment:		
	suck/swallow/breathe	use of SNS
	Regulation	pump before feeding
	3 suck/pause of 3 seconds	nipple shield
	<u>Dysfunctional Suck</u>	
Evaluation:	A) increased tone resulting in jaw clenching and retracted tongue	
	B) Decreased tone resulting in excessive wide jaw excursions and flaccid tongue	
	C) lack of rate change between NNS and NS	
Treatment:	A) longer nipple, dropper, finger feeding,	prone, side-lying, nipple shield finger feeding
	B) jaw support, cheek support	jaw support, cheek support
	C) peri-oral stimulation Rocking at rate of 1/second	peri-oral stimulation rocking at rate of 1/second

Evaluation of Reflexive Neonatal Sucking During Breast Feeding Based upon the NOMAS® (Neonatal Oral-Motor Assessment Scale)

1. Be sure to observe the start of nutritive sucking (rate of 1/second)

2. Rule out dysfunction: excessively wide jaw excursions and flaccid tongue; jaw clenching with tongue retraction

3. Observe coordination of suck/swallow with respiration. If well coordinated suck is usually normal. Signs of disorganized suck at the breast may include one or more of the following:

    *Difficulty with the coordination of pharyngeal swallow and respiration manifested by gulping sounds (audible swallows)
    *Pulling back of head
    *Head turning
    *Struggle to breathe with nasal flaring
    *Wiggle behavior, finger splays, movement of upper extremities

REMEMBER: A change in the suck/swallow/breathe ratio as well as variability in the number of sucks per burst are common occurrences during breast feeding.

Consultants' Corner

Recognizing and Resolving Infant Suck Difficulties

JC is an IBCLC with a private practice in a midwestern city. At a recent ILCA affiliate meeting, JC discussed the challenges of working with infants who have a disorganized or dysfunctional suck. JC and her colleagues agreed that the majority of infants with initial breastfeeding difficulties respond well to common interventions such as proper positioning and encouraging a deep latch. However, every now and then, they come across an infant who does not respond to their repertoire of interventions. For example, JC has had limited success in working with infants with jaw clenching. Although JC is in most cases able to recognize the specific deficit preventing nutritive sucking, she does not feel qualified to provide therapeutic interventions. Other lactation consultants at the meeting that day voiced a need for a therapist in their area that specializes in oral-facial therapy for the breastfed infant. There was general acknowledgment of the importance of health care practitioners knowing their limitations and referring clients to other specialists when needed. The dilemma faced by JC and her colleagues is the lack of specialists to whom they may refer clients. JC rhetorically asked, how do we find these specialists and evaluate their qualifications? What do we do when a specialist cannot be found?

Invited Response from Marjorie Meyer Palmer, MA, LSP

It is now possible to diagnose both disorganized and dysfunctional sucking in the neonate. This differentiation is often subtle and requires a special certification in the scoring and administration of the NOMAS®.[1] The 28 characteristics of sucking as identified by the NOMAS® allow for a fine discrimination between these reflexive sucking patterns. Disorganization of suck refers to a lack of rhythm of the total sucking activity,[2] which means that the infant is unable to coordinate suck and swallow with respiration. When an infant has a disorganized suck, he is unable to feed well and may exhibit labored breathing with color changes and/or spells of apnea and bradycardia. By comparison, a dysfunctional suck is characterized by abnormality in orofacial tone. When there is orofacial hypertonia, it may result in a restriction in the range of motion at the temporomandibular joint resulting in minimal jaw excursions and/or tongue retraction. When the posterior tongue is humped against the palate during sucking, a "clicking" sound is heard and sucking activity is described as noisy. This may also occur when the breast is not placed correctly in the mouth and does not fill the oral cavity or contact the posterior portion of the tongue. If repositioning does not help and mother complains of pain, there may be a more serious problem. When there is orofacial hypotonia, one may note a flaccid tongue and/or excessively wide excursions of the jaw with sucking. A dysfunctional suck pattern in the neonate has been correlated with later developmental delay at 24 months of age.[3,4] For this reason, a referral to an experienced professional is necessary. Infants with a dysfunctional suck will require therapeutic intervention to provide compensatory strategies during oral feeding. The overall prognosis for an infant who presents with a disorganized suck, however, is much better because the ability to suck/swallow/breathe in a coordinated fashion improves with neurological maturation and development.

Because the flow rate is variable during breastfeeding, the diagnosis of the sucking pattern for a breastfed

Consultants' Corner is a forum for the timely exchange of ideas, approaches, and opinions on lactation management issues. Readers are invited to share their experiences and opinions related to the case presentation and management plan. Submissions should be directed to the *JHL* editorial office and must be typed, double-spaced, and limited to 800 words. Submissions sent by e-mail (*jhl@ucdavis.edu*) or fax (530-752-7582) are encouraged. If you have particularly challenging breastfeeding cases that you would like to see discussed in the column, please let us know. We hope that Consultants' Corner will provide a convenient means to share your ideas, skills, and experiences in dealing with lactation challenges.

Marjorie Meyer Palmer is a speech pathologist, clinical instructor, and specialist in neurodevelopmental treatment and feeding disorders in the Department of Pediatrics at the University of California, San Francisco. Address correspondence to Marjorie Meyer Palmer, Department of Pediatrics, University of California, San Francisco, 3760 Yale Way, Suite 1A, Fremont, CA 94538, USA.

J Hum Lact 18(2), 2002

baby presents more of a challenge than that for the bottle-fed infant. When an infant on the bottle demonstrates too much variability in the number of sucks per burst or an inconsistent suck/swallow/breathe ratio, it is a clinical sign of a disorganized suck, whereas if an infant at the breast demonstrates this, it may be a sign that the infant has good adaptability and adjusts well to the variables inherent in the breastfeeding situation. A reliable clinical sign of a disorganized suck pattern at the breast is labored breathing with nasal flaring indicative of the inability of the infant to coordinate suck and swallow with respiration.[5] The evaluation of oral-motor patterns during reflexive sucking is not dependent on whether the infant is breastfed or bottle-fed. Characteristics of jaw and tongue movement may be accurately evaluated in either situation. Reflexive sucking is neurological and has little to do with environmental changes. However, it is advisable to evaluate the infant using the most familiar situation because some infants, particularly those who are premature, may demonstrate poor adaptability and do not easily change between breast and bottle.

Professionals certified in the use of the NOMAS® are usually available to come to the aid of the lactation consultant who suspects that a baby will require specific therapeutic intervention. Contacting the neonatal intensive care unit at a local hospital to request the name of the therapist who provides treatment for the babies with feeding problems in their unit would be a good place to begin. In addition, one should find out whether that professional is NOMAS® certified. A professional who is NOMAS® certified is able to accurately and reliability diagnose the sucking pattern of an infant at both the breast and bottle and to recommend appropriate treatment based on the diagnosis. The NOMAS® course addresses the differences in breastfed and bottle-fed infants and appropriate treatment approaches, and course participants often have the opportunity to evaluate breastfed infants at bedside in the intensive care and/or special care nurseries. In addition, many therapists are lactation consultants. A registry of certified professionals is available through Therapeutic Media, 1528 Merrill Road, San Juan Bautista, CA 95045, USA, for $3.00, or telephone (510) 651-2285 to inquire about a certified NOMAS® professional in your area. People interested in becoming NOMAS® certified may call the same telephone number or fax a request for information to (831) 623-9007.

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Sensory Aspects of Neonatal Sucking

Presented by Marjorie Meyer Palmer, M.A.,CCC-SLP
Speech Pathologist
Neonatal Feeding Specialist
Founder/Director, NOMAS International

Infants predisposed to sensory-based feeding disorders:

1) infants with **bronchopulmonary dysplasia/chronic lung disease**: characterized by difficulty breathing, difficulty coordinating suck/swallow with respiration, open mouth, tongue postured forward, aversive to having airway occluded

2) infants with **cardiac defects**: difficulty coordinating suck/swallow with respiration, fatigue easily, require more calories per kilogram of weight to grow

3) infants with **drug exposure**: sensory integration issues, poor adaptability, habituation, perseveration with feeds

4) infants with **gastrointestinal issues**: gastroesophageal reflux, tracheo-esophageal fistula, esophageal atresia, delayed gastric emptying, pyloric stenosis, dysmotility, etc.

5) infants who have been **intubated** or **suctioned** over prolonged periods, medically fragile, chronically ill, on ECMO, oral gavage, nasogastric tube feeds

Sensory Aspects of Neonatal Sucking

Presented by
Marjorie Meyer Palmer, M.A., CCC-SLP
Neonatal/Pediatric Feeding Specialist
Founder/Director, NOMAS® International

Clinical Symptoms of sensory-based oral feeding problems:

In the infant under three months:

Habituation: The infant is only able to respond to a novel stimulus. Once the novelty has diminished the infant no longer perceives its presence and the activity ceases. Also referred to as "sensory integration" and this is never normal when associated with oral feeding.

Perseveration: When a motor response to a sensory stimulus persists even once the stimulus has been removed.

Poor Adaptability: The infant is unable to transition easily and does not manage any changes in caregivers, positioning, bottle nipples, or breast to bottle feeding.

In the infant over three months: (visceral hyperalgesia)

Closing the mouth
Turning away
Pushing away the bottle or breast
Gagging or vomiting
Crying
Arching backward
Limited volume intake
Refusing feeds

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Compiled by Marjorie Meyer Palmer, M.A., CCC-SLP, January 2015

Diagnostic-Based Intervention for the Poor Feeder

Presented by Marjorie Meyer Palmer, M.A.
Speech Pathologist
Neonatal and Pediatric Feeding Specialist

Historical Perspectives on Neonatal Feeding

1980's- weak suck, poor suck
Pacing to aid infant in distress

1990's – disorganized, dysfunctional sucking (NOMAS®)
Regulation of suck/swallow/breathe to prevent discomfort and distress

PACING

- attend to infant's cues, cue-based
- subjective, based upon caregiver's judgment
- at signs of stress, remove nipple from the mouth
- re-insert once infant has recovered
- alleviates discomfort, distress once it has occurred

REGULATION of suck/swallow/breathe

- initial evaluation = disorganized suck (NOMAS®)
- objective, based upon normal developmental guidelines
- provide regulation for first minute of feeding to prevent discomfort, distress
- let infant take over feeding
- repeat in one-minute intervals as needed

Therapeutic Media Online Continuing Education

Diagnostic-Based* Intervention for the Poor Feeder

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Speech Pathologist
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For the infant under the age of three months who is demonstrating a **disorganized*** suck:

Modify the environment by:

- -maintaining the infant in a stable, secure midline position
- -holding rather than stroking or patient
- -minimizing environmental sensory input
- -building rhythmicity into the sucking experience
- -grading of intra-oral sensation

Modify the feeding experience by:

- -maintenance of the respiratory system
- -careful timing of the nipple presentation
- - practice with nasal breathing
- -use of primitive reflexes
- -consistent regulation of suck/swallow/breathe

For the infant under the age of three months who is demonstrating a **dysfunctional*** suck:

- -jaw support
- -cheek support
- -peri-oral stimulation
- -facilitation of central tongue groove
- -bolus control

*Diagnosis of suck pattern based upon the NOMAS®

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For the **disorganized** *feeder under three months of age who is demonstrating a reflexive suck:

1) consistent regulation of suck/swallow/breathe

2) first one minute of nutritive sucking

3) use of prescriptive technique

4) continue for second minute as needed

For the **dysfunctional*** feeder under three months who is demonstrating a reflexive suck:

1) jaw support

2) cheek support

3) facilitation of central tongue groove

4) peri-oral stimulation

*Diagnosis of suck pattern based upon the NOMAS®

Diagnostic-Based Intervention for the Poor Feeder

Suggested therapeutic materials:

ITEM	AVAILABLE FROM:
Sterile Clinic Dropper	Therapeutic Media 1528 Merrill Road San Juan Bautista, CA 95045 Order form available on www.nomasinternational.org
Mini-Haberman Feeder Bottle	Medela Inc. McHenry, IL 800-435-8316
Sterile Calgiswab, Type 1	Spectrum Laboratories Inc. 1100 Rankin Road Houston, TX 77073 800-634-3300
Pidgeon Feeder bottle	Children's Medical Ventures 541 Main Street S. Weymouth, MA 02190 800-377-3449
5 ml oral syringe/clear	Health Care Logistics, Inc. phone: 800-848-1633 FAX: 800-447-2923 www.hcl-intl.com
Sassy Baby Food Nurser Model #627	1534 College SE Grand Rapids, MI 49507 616-243-0767
Luv n' Care Spoon Feeder (Infant Feeding Set)	Luv n' Care P.O. BOX 6050 Monroe, LA 71211 www.luvncare.com

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NOMAS® International

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Treatment Strategies/Recommended Intervention for the Poor Feeder diagnosed with*:

Disorganized Suck Pattern:

Techniques 1-3 are supporting and teaching regulation of suck/swallow/breathe

Technique #4 is compensatory in nature and used to help the infant in distress

1. **Regulation of Suck/Swallow/Breathe**: allow infant to take three nutritive sucks with swallows then build in a pause of equal duration (approximately three seconds) to allow for breathing and/or swallowing if swallowing has not occurred with every suck. After the pause allow infant to take another three nutritive sucks with swallows. Continue this for one minute and then observe infant without intervention to determine whether or not he is able to self-regulate.
2. **Nipple Change**: some infants who have difficulty maintaining adequate respiration during sucking may be more successful with a slower flow nipple while infants who work hard with a slow flow nipple and demonstrate only intermittent swallows may perform better on a faster flow nipple. Some infants whose central tongue groove is less well defined may perform better on an orthodontic shaped nipple. For aerophagia select a nipple that advertises less air intake during bottle feeding
3. **Position Change**: side lying serves to slow transit time of liquid through the pharynx and may prevent gagging, choking, laryngeal penetration, and/or aspiration. Positioning on the left side aids gastric emptying for infants with GER. An upright position with more hip extension may be useful for infants with gastroesophageal reflux because it lessens the pressure against the abdomen. An upright position may also be used for those infants who have a cleft palate to decrease nasal pharyngeal reflux.
4. **External Pacing**: observe infant's stress cues and remove/tip bottle to offer a "break" so that infant can recover. This technique may be more often used for

those older infants who are closer to term and who demonstrate longer sucking bursts but an incoordination of respiration with suck and swallow.

Dysfunctional Suck Pattern:

<u>All techniques are compensatory in nature and require a "hands on" approach.</u>

1. **Chin Support**: the least invasive of the "hands on" therapy techniques. Provides slight upward support of the jaw during sucking and thus prevents excessively wide excursions that will interrupt the intra-oral seal on the nipple. Helps keep the tongue in closer proximity to the nipple and therefore, the nipple to the palate
2. **Cheek Support**: the MOST invasive of the "hands on" therapy techniques and should be used only with CAUTION. This firm pressure in and forward on the buccal cheek brings the lips onto the nipple and changes the placement of the anterior nipple seal. The suction component is increased which increases the bolus delivery size and may lead quickly to aspiration if the nipple is not changed to a slower flow. This technique decreases feeding times for many infants and if used safely can assist the infant to take his feeding more efficiently. This technique is contra-indicated in the infant with a disorganized suck who requires more time for respiration.
3. **Peri-Oral Stimulation**: a quick stretch to the buccal cheek using an inward and forward pressure with a release at the rate of one/second. This may be effective for the infant who is unable to change sucking rate between the NNS and the NS
4. **Facilitation of the Central Tongue Groove**: this technique is useful for those infants who demonstrate either a retracted or flaccid tongue. Using a finger with tubing placed on the upward side downward pressure may be applied to the tongue as liquid flows through the tubing during nutritive sucking. Pressure is applied centrally for the flaccid tongue and posteriorly for the retracted tongue.