Feeding and Swallowing in the Neonate

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Michigan Speech-Language-Hearing Association
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Disclosures

- **Relevant Financial Relationships:**
  - Salaried full-time employees with Henry Ford Health System at Henry Ford Hospital in Detroit
  - Not receiving any financial compensation for this presentation from employer or external facilities

- **No relevant non-financial disclosures**

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Background

- Undergraduate in Communication Sciences and Disorders, Master's in Speech Language Pathology
- Fellowship at HFH, subsequently hired as staff
- On the job training in NICU, self-study and courses for continuing education

Learner Outcomes

1. Normal and disordered neonatal development of feeding and swallowing
2. Evaluation of neonatal feeding and swallowing
3. Treatment and interventions for disordered neonatal feeding and swallowing.

“For the newborn and wise, everything begins small.”
— Suzy Kassem, Rise Up and Salute the Sun: The Writings of Suzy Kassem

ASHA

Knowledge and Skills Needed by Speech-Language Pathologists Providing Services to Infants and Families in the NICU environment

- 1.0 Role: Identification of infants at risk for and with existing developmental communication, cognition, feeding and swallowing problems
- 2.0 Role: Conduct clinical assessment of the infant and family for communication, cognition, feeding and swallowing problems, including neurodevelopmental assessments
- 3.0 Role: Conduct instrumental evaluation of the infant for feeding and swallowing problems
- 4.0 Role: Provide support and intervention/treatment for the infants communication, cognition, feeding and swallowing problems (evidence based when available)
- 5.0 Role: Provide education, counseling and support to families, other caregivers, and staff regarding preferred practices in the NICU to support current and future communication, cognition, feeding and swallowing skills
- 6.0 Role: Collaborate with other team members in identifying the need for additional assessments and consultations

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ASHA

Knowledge and Skills Needed by Speech-Language Pathologists Providing Services to Infants and Families in the NICU environment

- 7.0 Role: Collaborate with the family and other team members regarding management decisions for care of the infant and family
- 8.0 Role: Maintain quality control/risk management program
- 9.0 Role: Provide discharge/transition planning and follow-up care
- 10.0 Role: Educate and supervise SLPs, including clinical fellows and students in training
- 11.0 Role: Provide public education and advocacy for serving infants and families in the NICU
- 12.0 Role: Conduct basic and clinical research in fetal and neonatal development and function and effectiveness of treatments

- American Speech-Language-Hearing Association. (2004). *Knowledge and skills needed by speech-language pathologists providing services to infants and families in the nicu environment* [Knowledge and Skills]. Available from www.asha.org/policy.

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https://imgflip.com/memetemplate/122501176/Baby-question

Why are we in the NICU?

- Feeding is a complex sensorimotor task
  - > 20 muscles throughout mouth, throat, and esophagus
  - Cranial nerves
  - Coordination with respiratory system
    - Airway protection
  - All of the above have to work together to coordinate swallowing, airway protection and breathing !

Who do we see?

- Preemies, full term
- Syndromes, neurological disorders, respiratory disorders, Gastrointestinal disorders, etc.
- Feeding/swallowing, oral aversion
- Trach/vent
- Communication, cognition
- Craniofacial abnormalities including cleft palate, Pierre Robin, etc.
- Neonatal abstinence syndrome-
- ETC.

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Interdisciplinary team

- Family
- Neonatologist
- Pediatrician
- Gastroenterologist
- Therapy staff (PT/OT)
- Dietitian
- RN
- Radiologist
- Social Worker
- ENT
- Respiratory Therapist
- Lactation consultant
- ETC (surgeon, pulmonologist, dentist, psychologist…)

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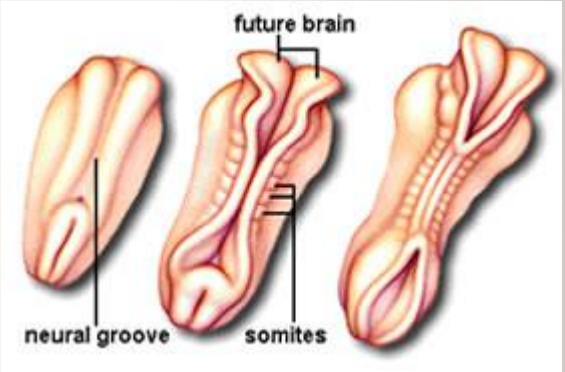
Embryology



- Week 3
  - Brain and heart are forming
  - Primitive mouth is present
- Weeks 4-8
  - Structures of swallowing start to develop
  - Larynx, tongue, palate, arytenoids and epiglottis begin to develop
  - Brain and 12 cranial nerves are present
  - Esophagus reaches its final length

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- Weeks 9-12
  - Facial features, limbs, fingers and toes present
  - CNS is functioning
  - Hard and soft palate fuse

https://www.todaysparent.com/pregnancy/pregnancy-by-week/your-pregnancy-9-weeks-pregnant/

- Weeks 13-16
  - Sex organs form
  - Skeleton begins to ossify
  - Pharyngeal swallow is developing

https://www.healthline.com/health/pregnancy/14-weeks-pregnant

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- Weeks 17-20
  - Pharyngeal swallow strengthens and fetus swallows amniotic fluid

- Weeks 21-25
  - Fetus may survive outside the uterus with special equipment and intensive intervention
  - Upper and lower respiratory system develop

- Weeks 26-29
  - Primitive reflexes begin (i.e. gag, phasic bite)
  - Lungs may be capable of breathing air with difficulty

- Weeks 30-33
  - Breathing patterns continue
  - Premature infant is still unable to safely coordinate suck-swallow-breathe

- Weeks 34-36
  - Premature infants may begin to breast or bottle feed
    - Most infants can sustain nutrition orally

- Weeks 37-40
  - Maturing suck-swallow-breathe
  - Oral nutrition is typically successful

https://www.babycenter.com/40-weeks-pregnant

Hall, K. (2001). *Pediatric dysphagia resource guide*. San Diego, CA: Singular/Thomson Learning.

Reflex	Stimulus	Behavior	Cranial Nerves Involved	Present at	Diminishes By	Significance
Gag	Touch to posterior tongue or pharynx	Mouth opening, head extension and floor of mouth opening	IX (glossopharyngeal) X (vagus) Cortex	26-27 weeks gestation	Continues throughout adulthood	May or may not be related to swallowing ability. Hyper or hyporespons e may indicate neurological problem
Phasic Bite	Touch/stimulation to the gums	Rhythmic up and down jaw movement	V (trigeminal)	28 weeks gestation	9-12 months of age	Precursor to mastication
Transverse Tongue Reflex	Stroking lateral surfaces of the tongue	Tongue moves toward the side of stimulation	XII (Hypoglossal)	28 weeks gestation	6 months of age	Precursor to lateralization
Tongue Protrusion	Touch to anterior tongue	Tongue protrudes from mouth	XII (Hypoglossal)	38-40 weeks gestation	6 months of age	To prepare infant to eat. Important to diminish to introduce spoon feeding.
Rooting	Stroking infant's check/mouth	Infant turns head toward stimulation	V (trigeminal) VII (facial) XI (Accessory) XII (Hypoglossal)	32 weeks gestation	3 months of age	May be present longer in breast-fed infants

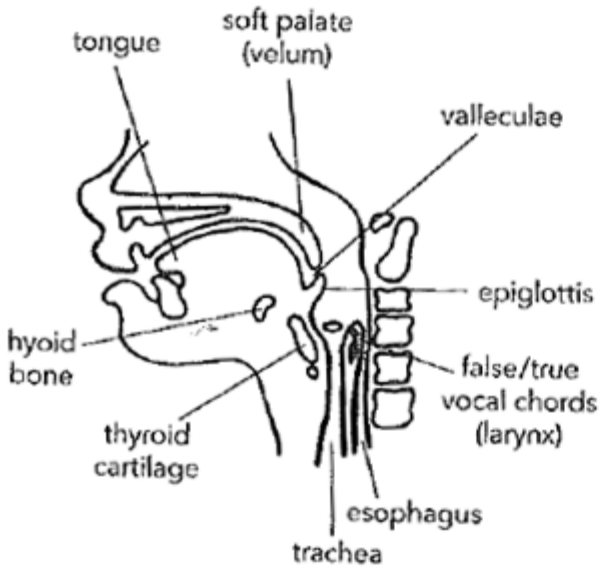
Hall, K. (2001). *Pediatric dysphagia resource guide*. San Diego, CA: Singular/Thomson Learning.

Suckling	Place nipple in mouth, stroke tongue or touch to hard palate	Backward and forward tongue movement and up and down jaw movement	V (Trigeminal) VII (Facial) IX (Glossopharyngeal) XII (Hypoglossal)	18 weeks gestation	6-12 months of age	Movement should be rhythmical Two types: Nutritive-nutritional intake and non-nutritive oral gratification
Sucking	Same as suckling	Up &down tongue movement.Smaller vertical jaw. excursion Jaw moves more independently	V (trigeminal) VII (facial) IX (glossopharyngeal) XII (hypoglossal)	6-9 months of age	24 months or older	Movement should be rhythmical. Lip seal around nipple is firmer.
Reflex	**Stimulus**	**Behavior**	**Cranial Nerves Involved**	**Present at**	**Diminishes By**	**Significance**
Grasp	Place index finger in infant's palm. Gently press.	Infant grasps finger		Birth to 2 months of age	4-6 months of age	For finger feeding and holding cup, spoon and bottle
Babkin	Apply deep pressure to infants palm	Infant opens mouth, closes eyes and brings head forward		Birth	3 months of age	To bring hand to mouth, Receive food into oral cavity

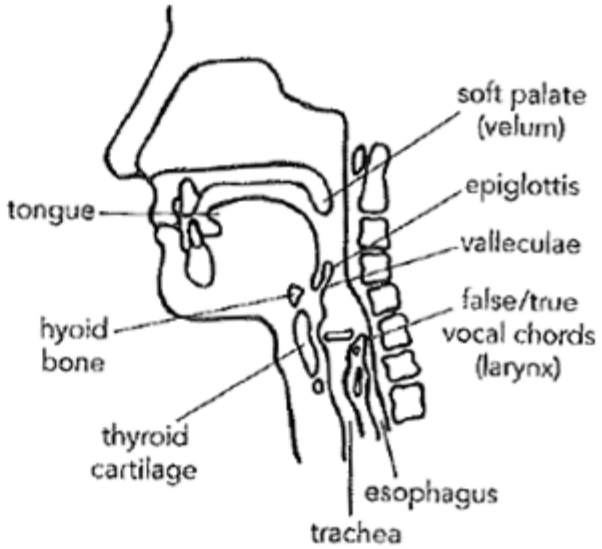
Hall, K. (2001). *Pediatric dysphagia resource guide*. San Diego, CA: Singular/Thomson Learning.

Palomental	Touch infant's palm	Infants chin wrinkles		Birth	3 months of age	To bring hand to mouth
Startle	Sudden movement backward or presentation of loud noise	Extension and abduction of arms and legs		Birth	3 months of age	Persistence interferes with infants ability to bring hands to mouth
Asymmetrical tonic neck (ATNR)	Turn infants head to one side	Face-side arm and leg extend. Skull side arm and leg flex.		Birth to 4 months of age	4-6 months of age	Also known as "fencer's" position. Persistence affects infant's ability to bring hands to midline and grasp and regard object at same time
Moro	Sudden head drop backwards	Abduction of arms with extension of elbows, wrist, and fingers followed by subsequent adduction of arms with shoulders and flexion of elbows.		28 weeks gestation	5-6 months of age	To "break up" predominant flexion postures at birth. Persistence may delay acquisition of head control.

Swigert, N. (2010). *The source for pediatric dysphagia* (2nd ed.). East Moline, Ill.: LinguiSystems.

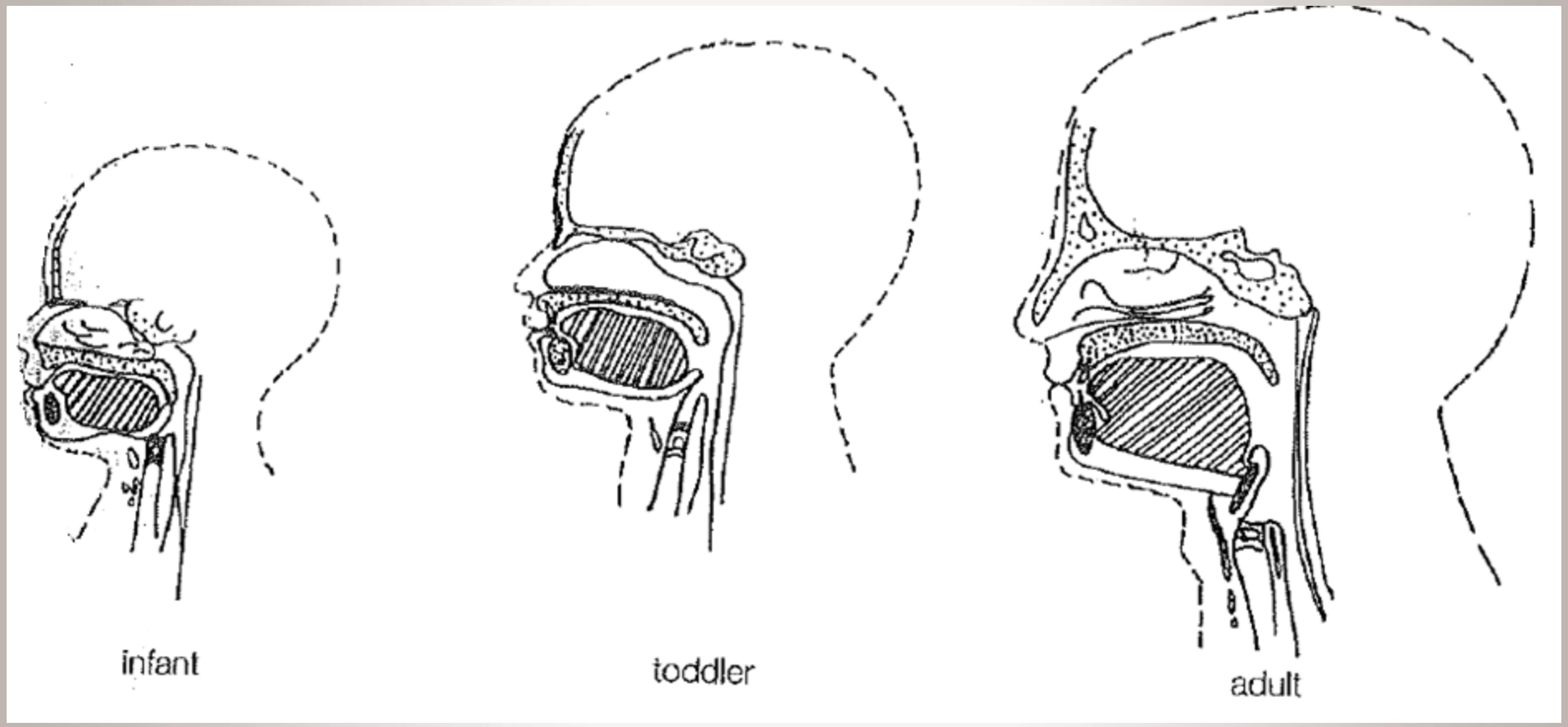


Infant



Adult

Hall, K. (2001). *Pediatric dysphagia resource guide*. San Diego, CA: Singular/Thomson Learning.



Terms Regarding Age

- Gestational age: Describes how far along a pregnancy is. Normal gestation is 38-40 weeks. If an infant was born at 32 weeks, their gestational age is 32 weeks. This number will not change.
  - 37-42= term
  - 28-<37= preterm
  - Under 28 weeks= extremely pre-term
  - Over 42 weeks= post term
- Post conception age (PCA)/ Post menstrual age (PMA)- age after conception or last day of Mother's last menstrual period. Weeks of age at birth (gestational age) + weeks of age since birth.
  - Example : 25 weeks at birth + 15 weeks since birth = 40 weeks PCA
- Chronological Age: Age since birth. If a baby was born 12 weeks ago. They are 12 weeks or 3 months old.
- Adjusted age (AA): Adjust age for how premature. This is the age of the baby based on his due date. Healthcare providers may use this age when they evaluate the baby's growth and development. So, if a baby is 6 months old, but was born two months early, his adjusted age is 4 months.

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Birth weight (BW)

- Over 2500gm (average neonatal BW)
- 1500-2499gm (low birth weight; lbw)
- 1000-1499 (Very low birth weight; VLBW)
- Under 1000gm (Extremely Low Birth weight; ELBW)
    - *450g= 1 lb
- AGA- appropriate for gestational age
- SGA- small for gestational age (weight and length are proportionate, but they are small)
- LGA- large for gestational age
- IUGR- intrauterine growth restriction (weight and length not proportionate, and they are small)

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Infant Stages of Alertness

- Stage 1- DEEP SLEEP
- Stage 2- LIGHT SLEEP
- Stage 3- DOZING/DROWSY
- Stage 4- QUIET ALERT
- Stage 5- ACTIVE ALERT
- Stage 6- ALERT AGITATED
- Stage 7- CRYING

Adopted from Brazelton (1984).

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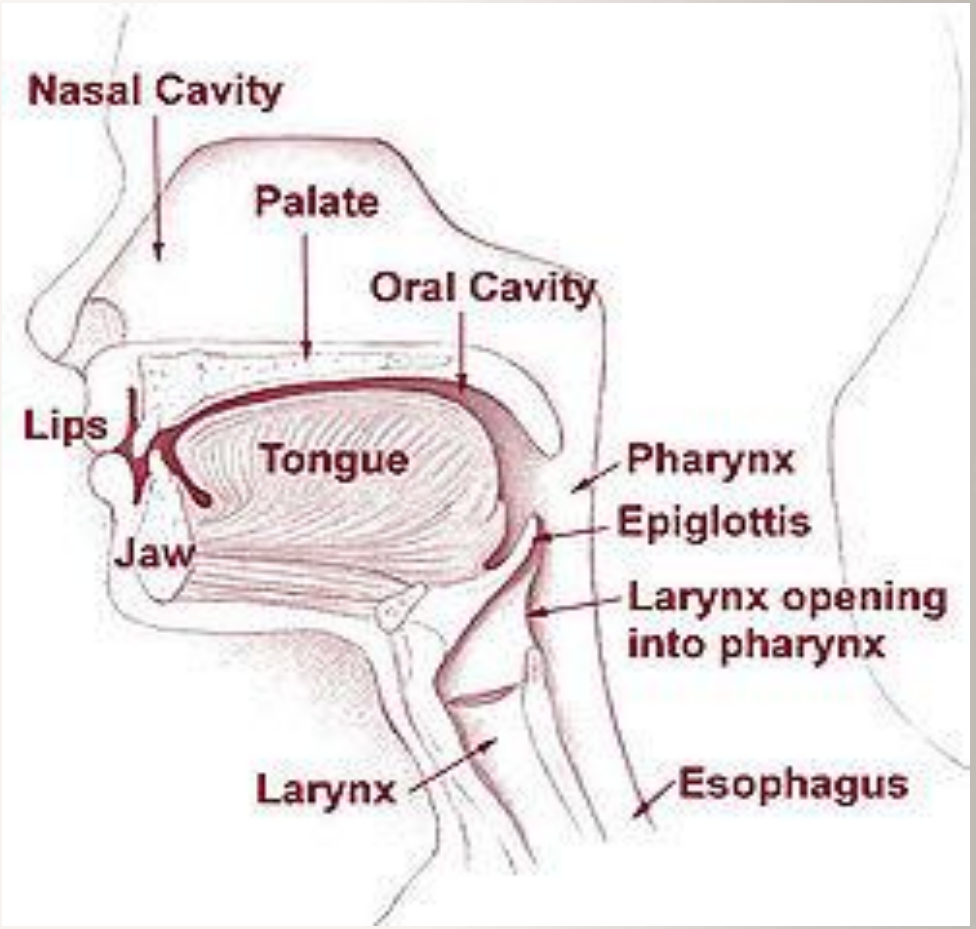
Phases of Swallowing

- Phases of Swallowing
  - Oral Preparatory
  - Oral
  - Pharyngeal
  - Esophageal



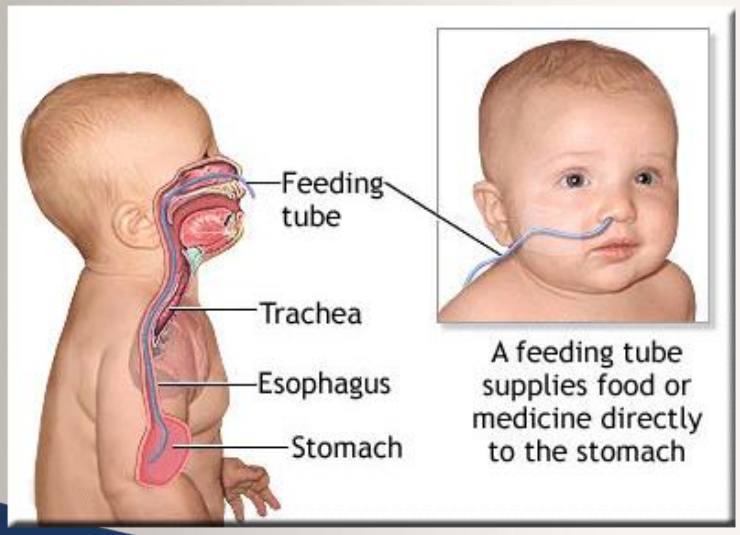
Terms

- Aspiration: The entrance of material below the level of the vocal cords (in the trachea)
- Penetration: The entrance of material into the supraglottic space (above the vocal cords)
- Residue: Material remaining in the pharynx after the swallow is completed

Types of Feeding Tubes

Enteral support or Gavage feeding refers to tube feeding

- Orogastric tube- inserted in the mouth and goes down pharynx, esophagus and into the stomach



- Nasogastric- inserted into one side of the nose into the pharynx and esophagus and into the stomach

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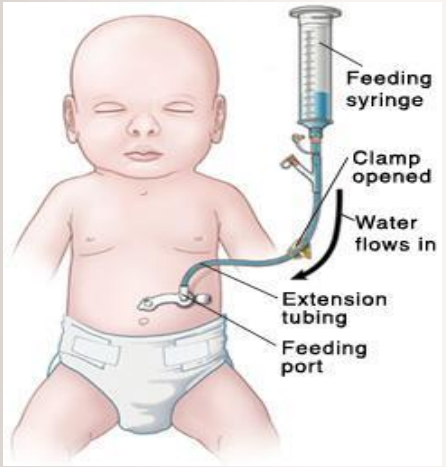
Types of Feeding Tubes

- Gastrostomy Tube (G-tube or PEG)- inserted through the abdominal wall and into the stomach
- Jejunostomy Tube (J-tube or PEJ)- inserted into the jejunum (a portion of the small intestine between the duodenum and the ileum)
- Gastrostomy- Jejunostomy tube (G-J tube or PEG-J)- connected tube with one end inserted into the stomach and the other into the jejunum



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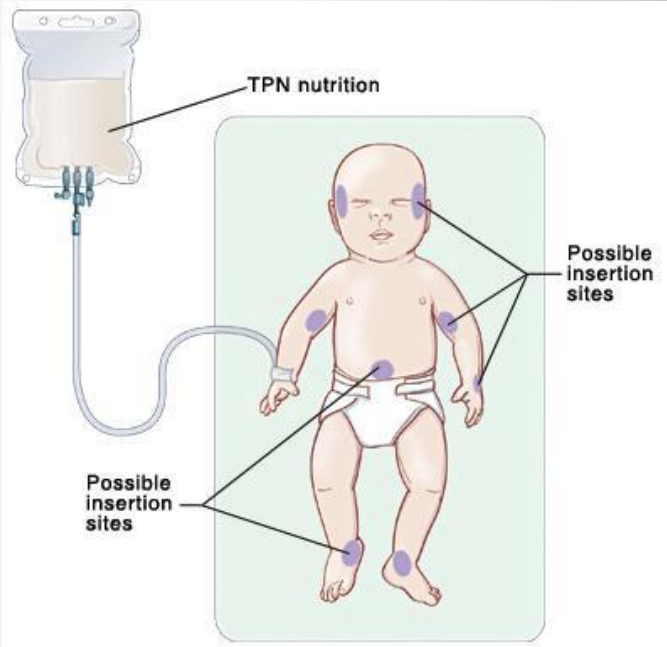
Types of Feeding

- TPN: Total Parenteral Nutrition
- Bottle Feeding
- Breast Feeding
- Any combination



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Medical conditions that may affect feeding

- Neurologic
- Respiratory
- Structural
- Cardiac
- Gastrointestinal
- Infant of Diabetic Mother
- Prenatal drug exposure
- Prematurity
- ETC.

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Oxygen Support

- Room air
- Nasal Cannula
- High Flow Nasal Cannula
- Nasal CPAP
- Oxyhood
- Mechanical ventilation

Physiology

- Heart Rate
  - Normal: 100-200 beats per minute (ideal 120-160)
  - Bradycardia: below 100 beats per minute
- Respiratory Rate:
  - Normal: Newborn 20-40 bpm, Preemie: 40-60 bpm
  - Tachypnea: over 60 bpm
- Apnea: cessation in breathing for more than 20 seconds
- Oxygen saturation:
  - Percentage of 100%, concerned if under 85
- Color change

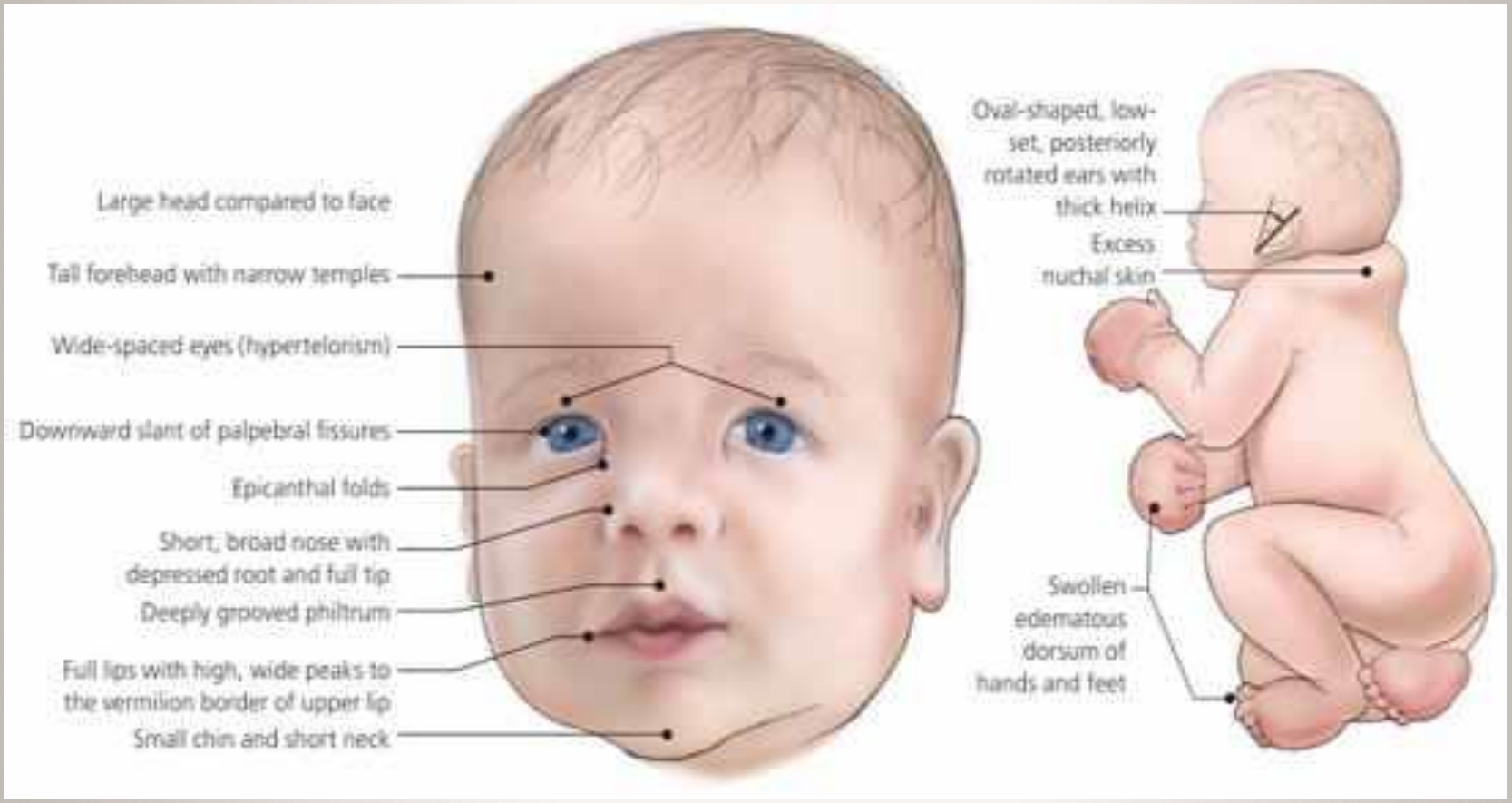
Suck-Swallow-Breathe

- Infants are obligatory nose breathers because of their anatomy
- Swallowing coincides with stoppage of breathing (airway is closed)
- Infant must effectively coordinate sucking, swallowing and breathing to be a successful feeder
- Observed as early as 31 weeks, but not functionally mature until 37-38 weeks or beyond

Evaluation of Feeding

- Bedside Evaluation
  - History:
    - Case history, feeding history, why were we consulted?
  - Observe the infant at bedside:
    - State Regulation, Physiologic stability, readiness to feed?
  - Perform Oral Motor Examination
  - Swaddle, sensory integration
  - Non-nutritive suck
  - Feeding
  - Discussion

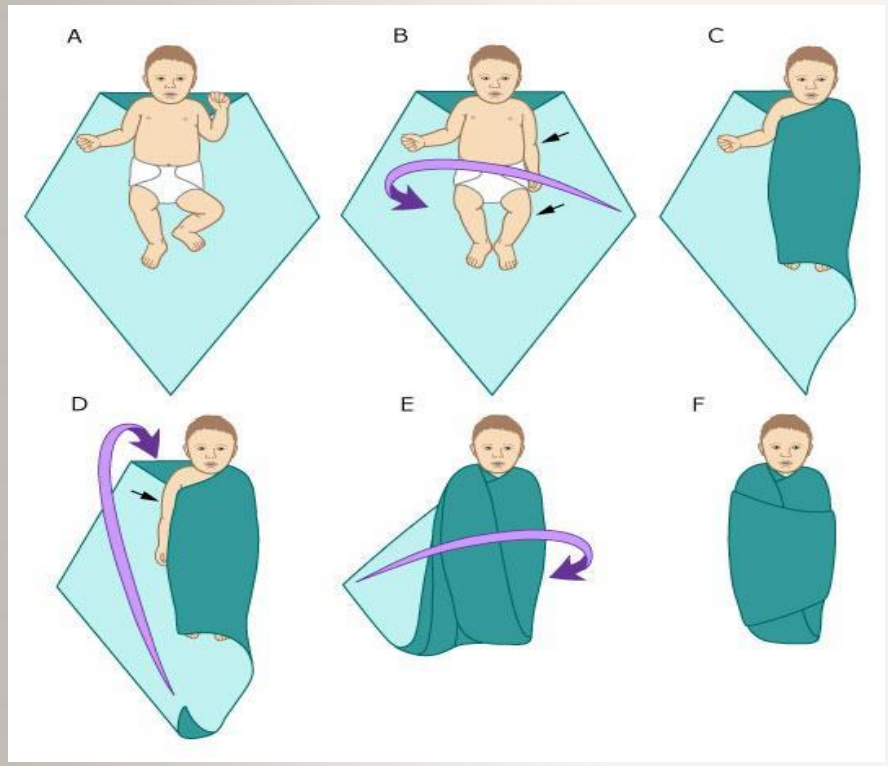
Dysmorphic Features



Swaddling

- Pending infant's age and skillset, we typically recommend **swaddling** in addition to position to promote physical organization and maintain postural stability
- Promoting physical organization while minimizing extraneous movements results in increased endurance and focus for oral feeding (Ross, 2008)

Swaddling



Non-Nutritive Suck

- Sucking that does not provide nutrition (i.e. pacifier)
- Provides early oral motor experiences that are essential for oral sensorimotor development
- Calming, soothing and state-regulating activity
- Helps adapt to new environments, self-stabilize, increase oxygen saturation levels and increase feeding performance
- Typically twice as fast as the nutritive suck (2 sucks per second)
- Breathing should be continuous and regular and only interrupted by swallowing (saliva)

Infant Driven Feeding

- Safe, functional and appropriate feeding in the NICU that is not volume driven, rather *INFANT* driven.

- "Undue stress during feeding may predispose the infant not only to safety issues but also to long-term learned refusals. Repeated negative experiences during feeding may lead to maladaptive feeding behaviors and aversions because neuronal mapping is occurring rapidly during the time when preterm infants are learning to feed." (Shaker, 2013)

- Cue based, co-regulated feeding

- Every feeding experience should be positive

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Readiness to feed?

Feeding Readiness Scale	
1	Drowsy, alert or fussy before care Good tone (presupposes autonomic stability)
2	Drowsy or alert once handled Some rooting or taking of pacifier Adequate tone
3	Briefly alert with care No hunger behaviors No change in tone
4	Sleep throughout care No hunger cues No change in tone
5	Needs increased oxygen with care Apnea and or/bradycardia with care Tachypnea greater than baseline with care

Ludwig, S., & Waitzman, K. (2007). Changing Feeding Documentation to Reflect Infant-Driven Feeding Practice. *Newborn and Infant Nursing Reviews,* 155-160.

Quality of Nippling Scale

B. Quality of nippling scale

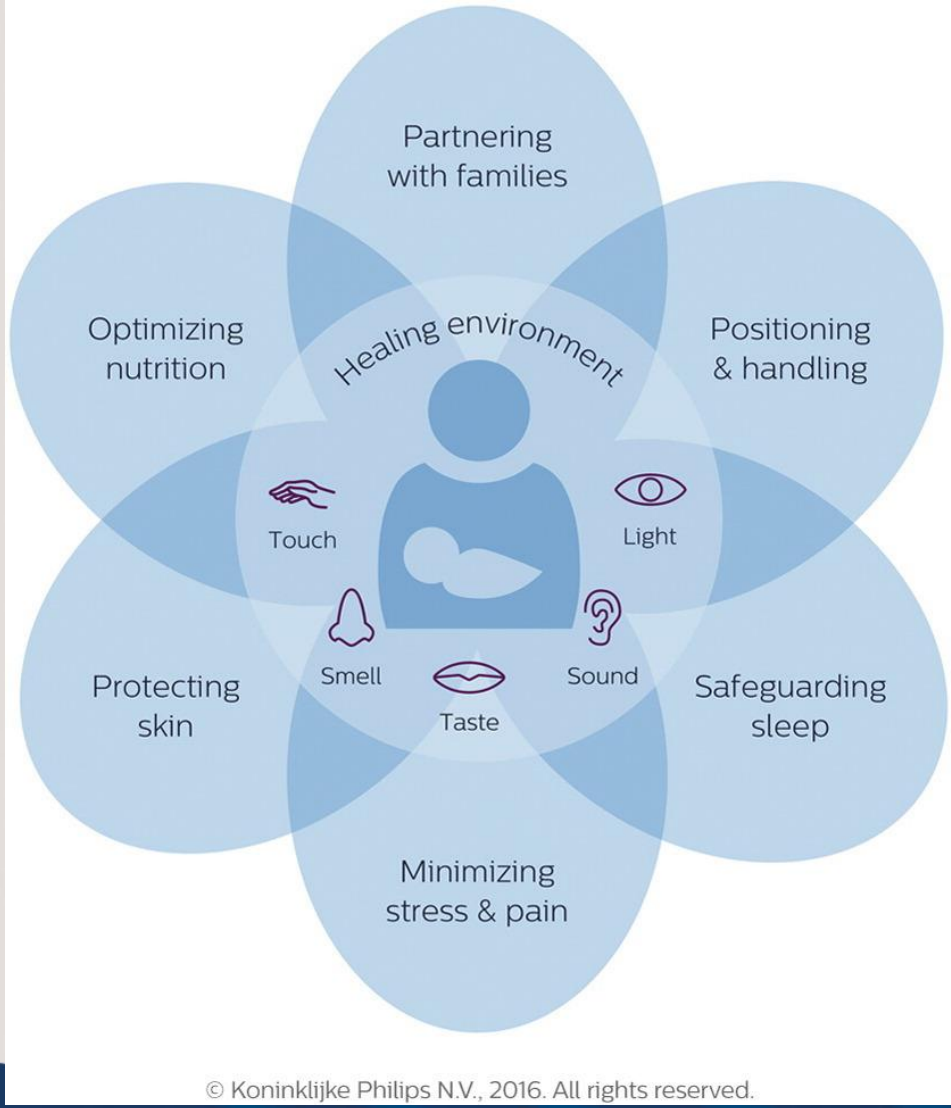
1	Nipples with a strong coordinated suck throughout feed
2	Nipples with a strong coordinated suck initially but fatigues with progression
3	Nipples with consistent suck but has difficulty coordinating swallow, some loss of liquid or difficulty in pacing Benefits from external pacing
4	Nipples with a weak/inconsistent suck, Little to no rhythm, may require some rest breaks
5	Unable to coordinate suck-swallow-breathe pattern despite pacing, may result in frequent or significant *A/B*s or large amounts of liquid loss and/or tachypnea significantly greater than baseline with feeding

C. Caregiver technique scale

A	External pacing
B	Modified sidelying
C	Chin support
D	Cheek support
E	Oral stimulation

Ludwig, S., & Waitzman, K. (2007). Changing Feeding Documentation to Reflect Infant-Driven Feeding Practice. *Newborn and Infant Nursing Reviews,* 155-160.

NEUROPROTECTION



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Signs of Stability During Feeding (Shaker, 1999)

- Smooth, regular respirations
- Hands actively to the body midline, near face, with good postural control
- Organized, calm and pink
- Focused clear alertness
- Good coordination of suck-swallow-breathe

Spot the Differences

https://linkstudio.info/portfolio/pediatric-swallowing/

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Signs of stress during feeding (shaker, 1999)

- Change in state of alertness
- Change in color
- Change in breathing
- Change in postural control
- Disruptions in swallowing
- Fingers splayed
- Extension of limbs
- Locked into stimulus
- Hyperalert

Signs of Stress

- Changes in breathing-
  - Stridor
  - Stridorous yelping
  - Grunting
  - Regulating respiration
  - Regulating short staccato breaths
  - Using accessory muscles
- Changes in swallowing
  - Gulping
  - Multiple Swallows
  - Throat clearing
  - Tongue clicking
- Behaviors of distress related to feeding
  - Based on bolus mis-direction

Thoyre, S., Shaker, C., & Pridham, K. (2005). The Early Feeding Skills Assessment for Preterm Infants. *Neonatal Network: The Journal of Neonatal Nursing*, 7-16.

What can we do to help infants during feeding?

- Non-nutritive Intervention
- Pacing

https://www.youtube.com/watch?v=d85p0sLPv_4

- Positioning
  - Sidelying
  - Semi- upright
  - Upright

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What can we do to help infants during feeding?

- Flow rate

- Thickening

- Cheek and Jaw Support

Non-Nutritive Intervention

- What is it?
  - Intervention for pre-feeding skills, typically when feeding is not safe
- Why do we do it?
  - To promote oral feeding, reduce aversions, etc.
- How do we do it?
  - Pacifier, gloved finger, holding, etc.
- When do we do it?
  - When unsafe for oral feeding

External Pacing

- What is it?
  - Feeder imposes a break and cues the infant to rest
- Why do we do it?
  - To prevent fatigue and/or physiologic deregulation
- How do we do it?
  - Tip bottle down to stop flow of material to the nipple. If keeps sucking, take bottle out and place to lip to promote organization.
- When do we do it?
  - **Before** they demonstrate stress cues

Infant Positioning

- What do we mean when we say "positioning"?
  - The position in which the infant is being held during a feed
- Why do we care?
  - Certain positions can benefit the infant in a variety of ways - all dependent upon the infant's needs and medical history
- How do we position?
  - Physically manipulating the infant's position within the feeder's arms
- When do we decide to change the infant's position?
  - For our preemies, we typically begin in elevated sidelying (unless medical history provides rationale to begin with alternate position)
  - We will alter an infant's position if determined it will benefit the infant during or following evaluation

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Infant Positioning

Upright

- True/Fully
- Semi-/Cradled

Sidelying

- True
- Semi-elevated

Upright and Semi-Upright Positioning

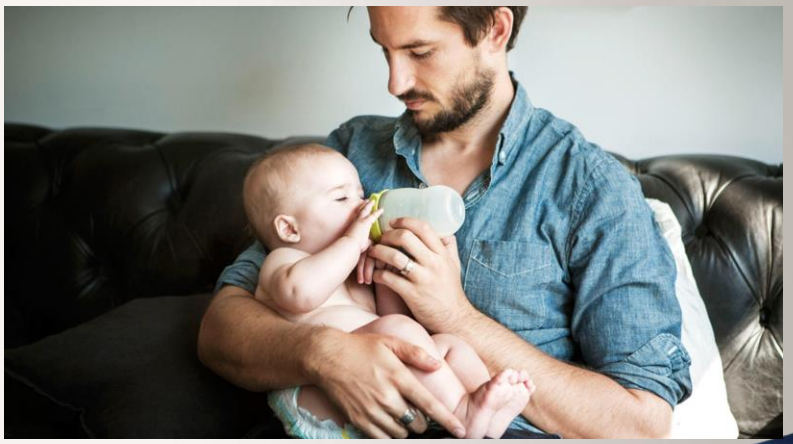
Position that typical/healthy newborns are fed in

Benefits:

- Great for reflux
- Appropriate for babies who fatigue easily - helps maintain alertness
- Cleft palate
- Social communication
- Comfortable for parents

Cons:

- More anti-gravity work
  - Working to coordinate swallow against the work of gravity
- Postural instability
- Vestibular - “fear of falling”
- Unvented bottles - increase in flow rate due to hydrostatic pressure with position of bottle



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Sidelying & Semi-Elevated Sidelying Positioning

Typically use semi-elevated sidelying, unless CLD is severe

Semi-Elevated Sidelying

- Natural position done when breastfeeding
- Benefits: Improved oxygen saturations, decreased work of breathing (easier belly movement for A-P rib cage movement), decreased heart rate variability, improved state regulation, improved swallowing safety, improved physiologic stability, flow rate not adversely affected by gravity
  - No adverse effects
- Cons: Current literature does not provide strong statistically significant evidence in support of ESL (Park et al, 2018)

Clark et al., 2007
Girgin et al., 2018
Park et al., 2014
Thoyre et al., 2014

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Flow Rates

- What is Flow Rate?
  - Rate at which milk or formula is moved from the modality (bottle or breast) to infant's mouth
- Why do we care?
  - Nipple flow rate can affect infant's ability to feed safely and efficiently and to maintain oxygenation
  - Flow rate (especially when too quick) can alter infant's Suck-Swallow-Breathe coordination
- How do we alter the flow rate?
  - Variety of nipples that offer variety of flow rates
- When do we decide to change the flow?
  - If infant is demonstrating drooling, appears overwhelmed by fluid intake, SSB coordination is impaired, and/or concern for aspiration

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Slow Flow Nipples

- Majority of our infants benefit from slow flow nipples
- Many different types of slow flow nipples that range in flow rates
  - AKA a "slow flow" of one brand does not equal the "slow flow" of another brand
- Flow rates can vary across brands and within brand of the same type
  - AKA a "slow flow" of one brand may not equal a "slow flow" within that same brand

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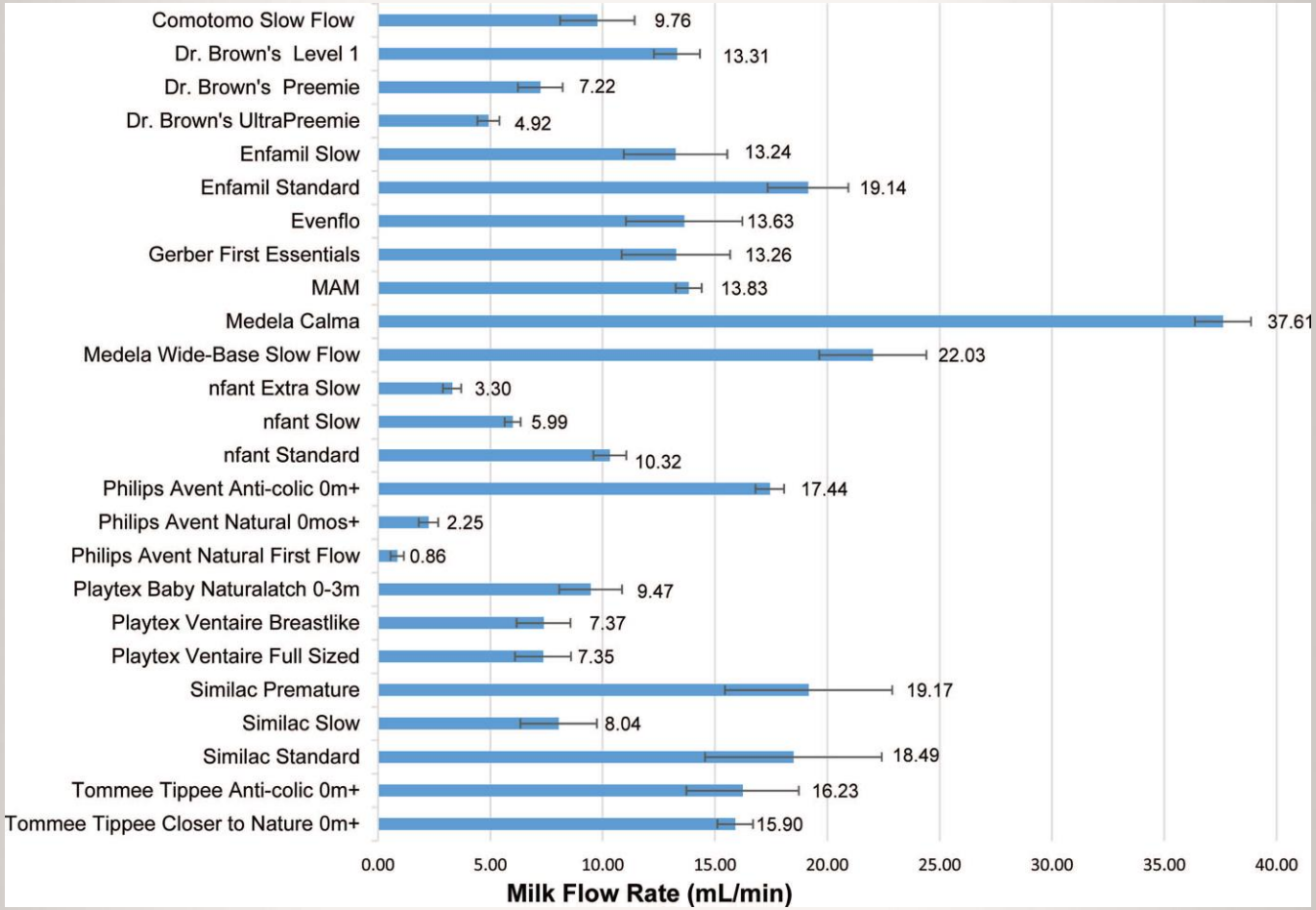
PADOS 2019



Pados, B. F., Park, J., & Dodrill, P. (2019, February). Know the flow: Milk flow rates from bottle nipples used in the hospital and after discharge. *Advances in Neonatal Care*, *19*(1), 32-41. doi:10.1097/ANC.0000000000000538

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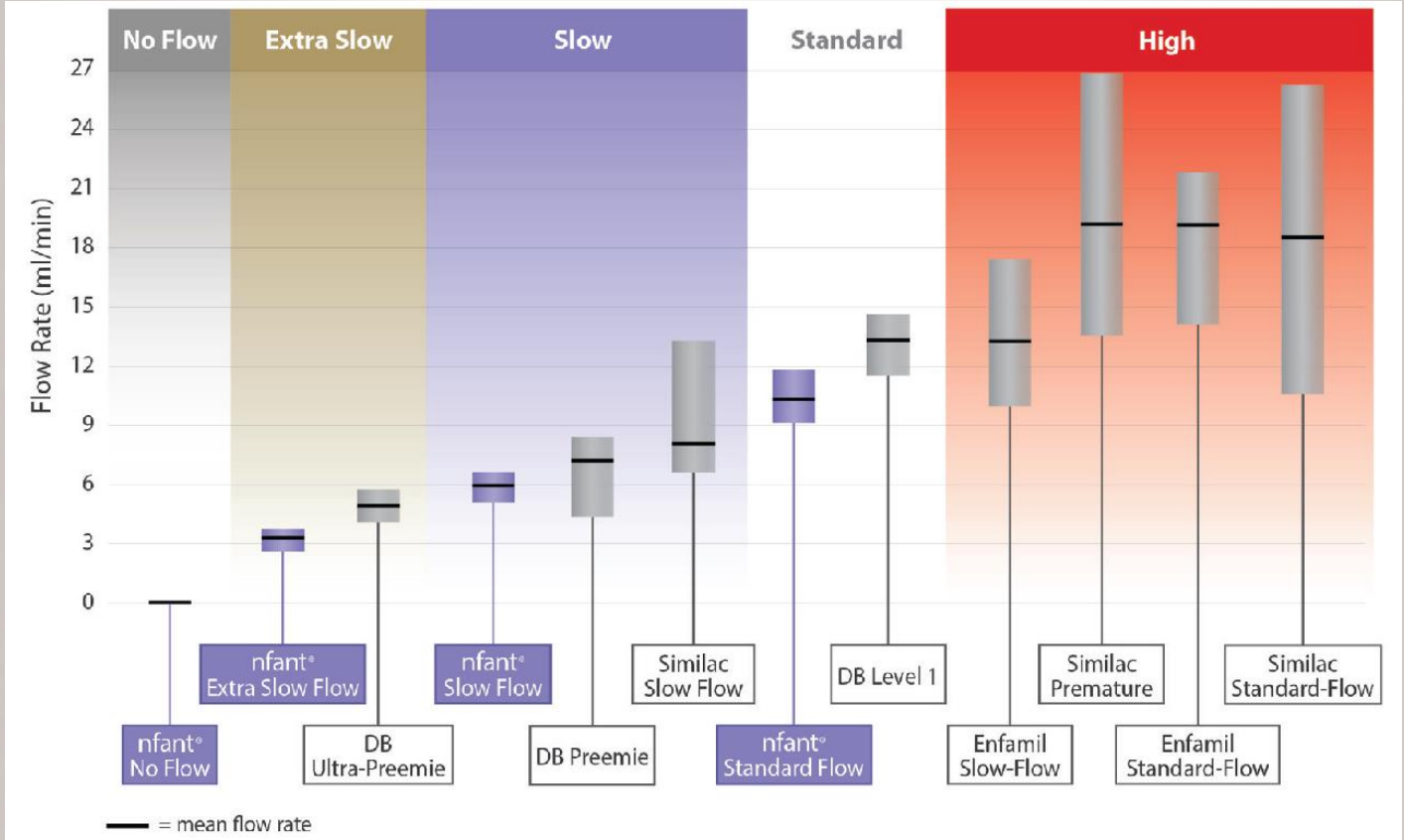
nFant Labs

Clinical Evidence Guide 2019



Slow-Flow Nipples

Slow-flow nipples reduce the rate of milk flow from the bottle when your baby feeds. If recommended, a slow-flow nipple can reduce infant stress during feeding, decrease negative feeding experiences, and increase tolerated amount of oral intake.

 Dr. Brown's	**Standard Preemie Flow** Nipple price: $2-3 per unit	**Standard Level 1** Nipple price: $2-3 per unit
	Bottle price: $5-7 per bottle Highly reliable flow rate across nipples	
 Tommee Tippee	**Feeding Bottle Slow Flow** Nipple price: $6-8 per unit Bottle price: $6-8 per bottle Highly reliable flow rate across nipples	
 Avent	**Classic Newborn Flow** Nipple price: $5-10 per unit Bottle price: $7-10 per unit Moderately reliable flow rate across nipples	
 Playtex	**VentAire Wide Slow Flow** Nipple price: $4-6 per unit Bottle price: $2-3 per unit Moderately reliable flow rate across nipples	
 Nuk	**Slow Flow** Nipple price: $2-3 per unit Bottle price: $5 per unit Moderately reliable flow rate across nipples	

 Enfamil	**Slow Flow** Nipple price: $1 per unit Bottle price: $1 per unit Moderately reliable flow rate across nipples Fits on a variety of standard-sized bottles
 Evenflo	**Classic Slow Flow** Nipple price: $1-2 per unit Bottle price: $2-4 per unit Moderately reliable flow rate across nipples
 Similac	**Slow Flow** Nipple price: $1-2 per unit Moderately reliable flow rate across nipples Fits on a variety of standard-sized bottles
 Medela	**Wide Base Slow Flow** Nipple price: $2 per unit Bottle price: $2 per unit Moderately reliable flow rate across nipples

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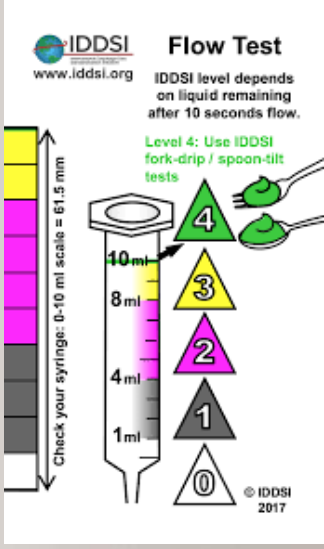
Thickening

- What is it?
  - Purposefully altering the viscosity of a liquid to slow flow and/or assist with reflux
- Why do we do it?
  - May result in improved management of the bolus necessary to coordinate suck-swallow-breathe
  - Thought to increase weight allowing liquid to stay in the stomach rather than be refluxed
- How do we thicken?
  - Rice cereal, oatmeal, gelmix infant thickener, formula with added starches, natural thickeners when age appropriate (e.g. applesauce), etc.
- When do we decide to thicken?
  - Rarely and only if all else fails
  - Only following objective evaluation of swallowing (VFSS, FEES)



Food for thought…

- No standard thickening practice
- Viscosity trialed during VFSS (barium) vs. consistency provided during feedings
- Sample size
- Dwell time
- Temperature
- Breastfeeding outcomes
- Effects of thickening on the GI system
- Simplythick 2011-2012
  - 22 cases of infants with NEC, 7 died
  - One infant was full term,not preemie

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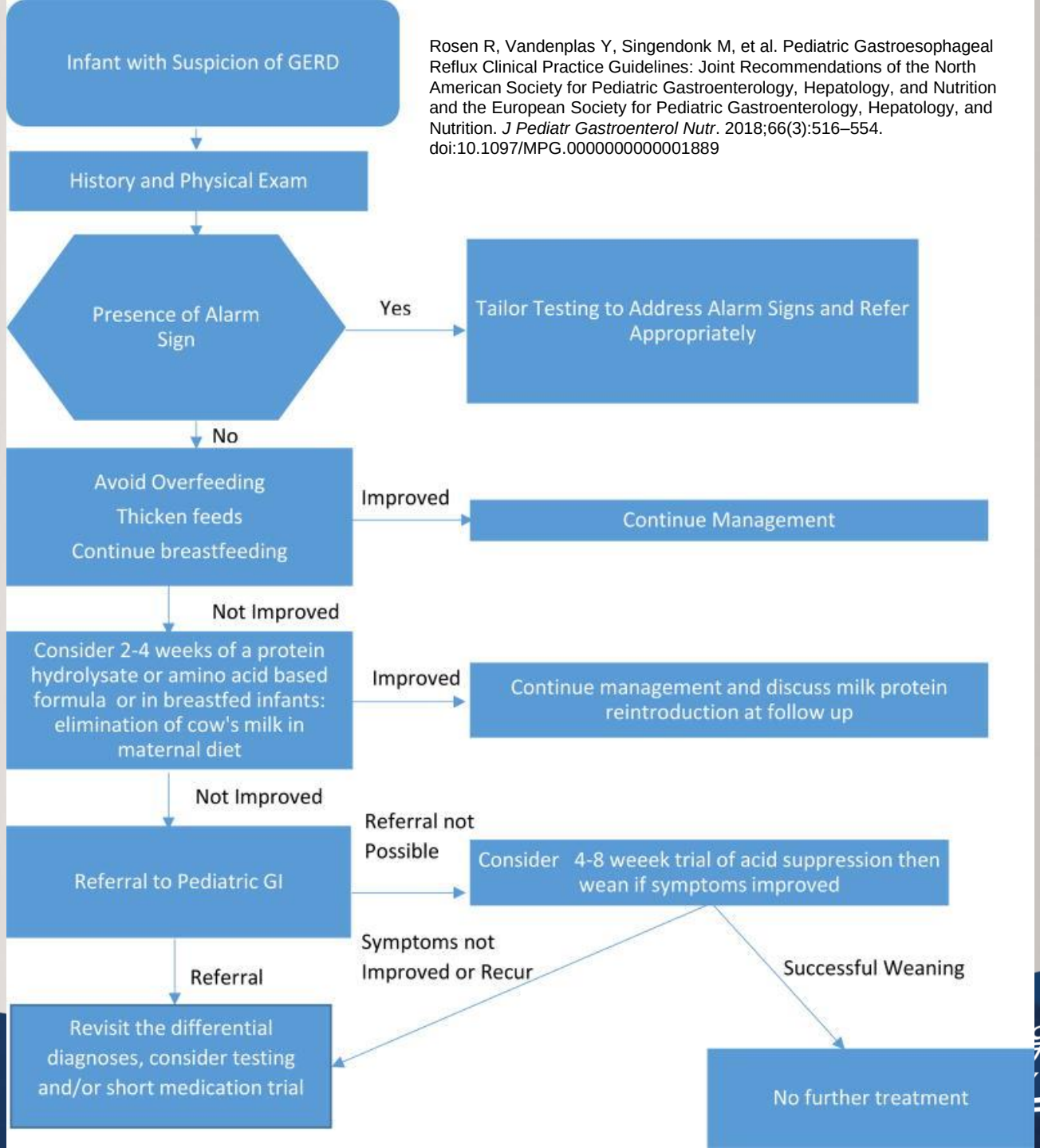
Pediatric Gastroesophageal Reflux Clinical Practice Guidelines



Rosen R, Vandenplas Y, Singendonk M, et al. Pediatric Gastroesophageal Reflux Clinical Practice Guidelines: Joint Recommendations of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *J Pediatr Gastroenterol Nutr*. 2018;66(3):516–554. doi:10.1097/MPG.0000000000001889

Cheek and Jaw support

- What is it?
  - Support to cheeks and/or chin during feeding
- Why do we do it?
  - Support and stabilize and in theory improve suction
- How do we do it?
  - Cheek support -Typically thumb and middle finger of non-feeding hand
  - Chin support- Typically pinky of feeding hand
- When do we do it?
  - Low tone
  - Difficulty stabilizing nipple
  - Unstable or wide jaw movement

- Caution: fluid flow changes (increases) and coordination of SSB may become more challenging (Shaker, 1999).

Hwang, Y. S., Lin, C. H., Coster, W. J., Bigsby, R., & Vergara, E. (2010). Effectiveness of cheek and jaw support to improve feeding performance of preterm infants. *American Journal of Occupational Therapy*, *64*(6), 886-894.

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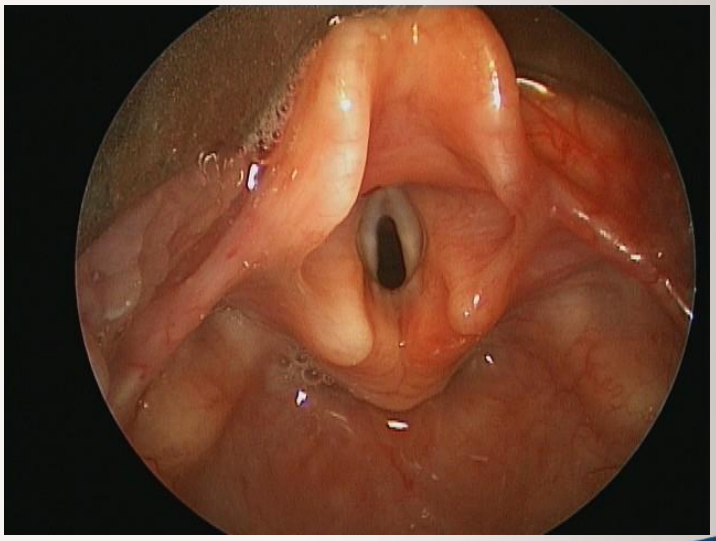
Instrumental Evaluation of Swallowing

- Videofluoroscopic Swallowing Study

- Fiberoptic Endoscopic Evaluation of Swallowing



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Example VFSS

- What happens during VFSS
- Normal swallowing in Neonate
- Aspiration
- Structural abnormality
  - Shaughnessy EE, Towbin A, Prosser J. Neonate With Choking. *JAMA Pediatr.* 2015;169(3):281–282. doi:10.1001/jamapediatrics.2014.2910

Example FEES

- FEES

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Progression of Oral Feeding

- 0-4 months: liquids, bottle, breast
- 6 months: purees, spoon, bottle
- 6-9 months: soft chewables, “sippy cup” drinking
- 9-12 months: Lumpy textures
- 12-18 months: all textures, straw drinking
- 18-24 months: more chewable foods
- 24 months: tougher solids

Case Studies

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Pierre Robin

Pierre-Robin Syndrome

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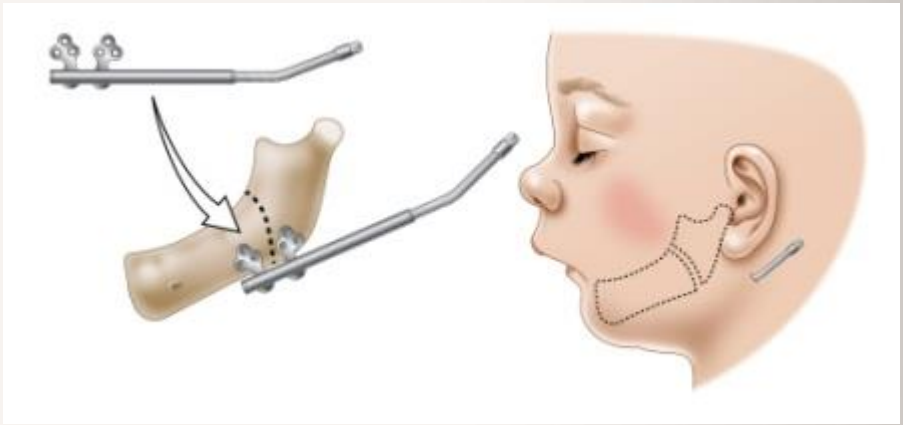
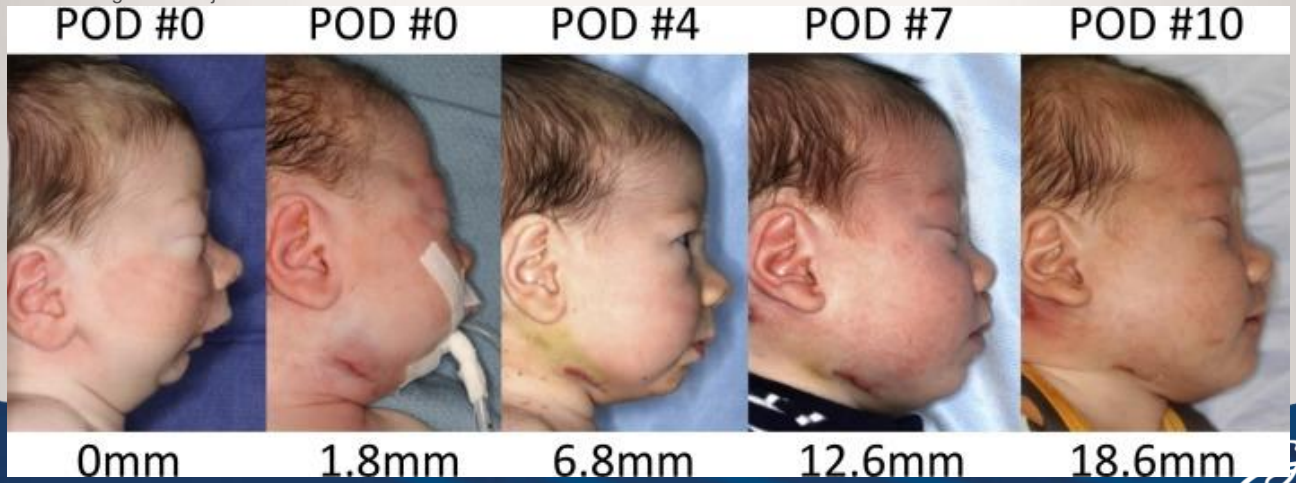
Jaw distraction surgery (mandibular distraction)

https://www.cincinnatichildrens.org/health/n/jaw-distraction



https://www.rch.org.au/kidsinfo/fact_sheets/Jaw_distraction_surgery/



Resnick CM. Precise osteotomies for mandibular distraction in infants with Robin sequence using virtual surgical planning. Int J Oral Maxillofac Surg 2017; [Epub ahead of print].

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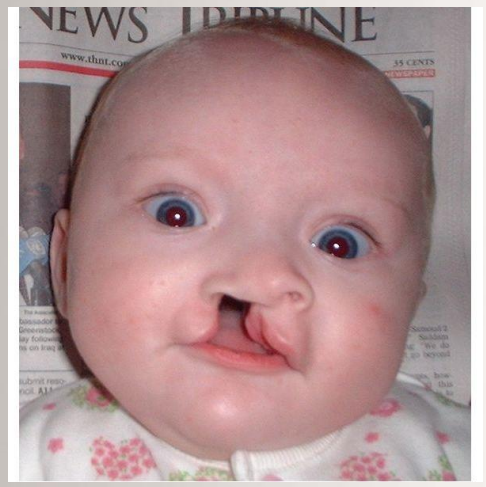
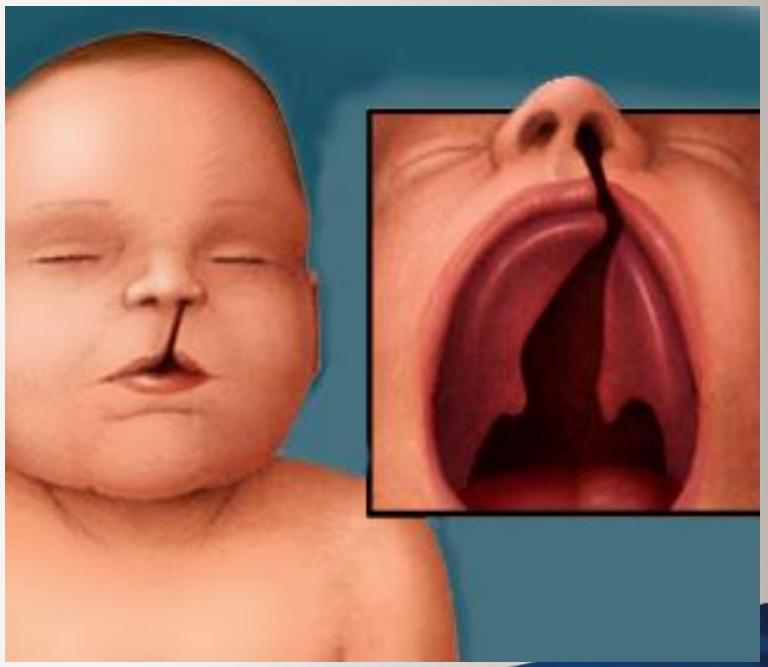


Cleft lip and palate



Specialty Feeders

- Infant Driven Feeding System: the infant is in control meaning your baby will eat at their own pace with use of these nipples
- Caregiver Driven Feeding System: the caregiver is in control of the feeding; you as the parent will squeeze to provide milk and/or flow

Special Needs by Medela Feeder (formerly Haberman) - Caregiver driven feeding system

Advantages: 3 flow settings , nipples and rings compatible with regular Medela bottles, one way valve decreased air intake

Disadvantages: all caregivers planning to feed the infant would require training on use, price, nipples require frequent replacement, hand wash required for cleaning

Price Range: $20.00 - $40.00

Where to Buy: Medela's website, buybuy Baby, Amazon, Bed Bath & Beyond, Medex Supply, Children's Hospital of Michigan

Dr. Brown's Specialty Feeding System - Infant driven feeding system
Make sure the one you buy has the one-way valve.

Advantages: Consistent and reliable nipple flow rate, reusable system, decreases air intake, physical appearance of typical bottle, easy to clean – dishwasher safe, easy assembly and use across different caregivers, assists with self-regulation, encourages proper neck position, various flow rates

Disadvantages: cost

Price Range: $19.99 for a 2-pack - $39.99 for a starter pack

Where to Buy and Cost: Amazon, Kohl's, Walmart, eBay

Mead Johnson - Caregiver driven feeding system

Advantages: inexpensive, soft nipple

Disadvantages: disposable - not reusable, all caregivers planning to feed the infant would require training on use, long nipple may lead to increase gag response, tendency to leak due to poor airflow

Price Range: Average $20 for pack of 6 on Enfamil, or $5 – 10 for individual

Where to Buy: Walmart, Enfamil website, Vitality Medical online, ExpressMed.com,

Pigeon Nipple and Bottle - Infant driven feeding system

Advantages: nipple will fit on majority of regular bottles, nipple is thicker on top and softer on bottom for easier compression, air vent to minimize air intake, does not require suction, easy feeding from all caregivers, appearance of a standard bottle

Disadvantages: expensive, firm side of nipple can cause a sore, hand wash required for cleaning

Price Range: range from $16-30, nipples individually ~$5-7 each

Where to Buy: Amazon, Philips Healthcare Online, Vitality Medical online, ExpressMed.com, Medex Supply

**Never cut the nipple of any specialty feeder or flow rate bottle.*

Please contact Henry Ford Speech-Language Pathology for additional questions/concerns (313)916-2960
Revised July 2019

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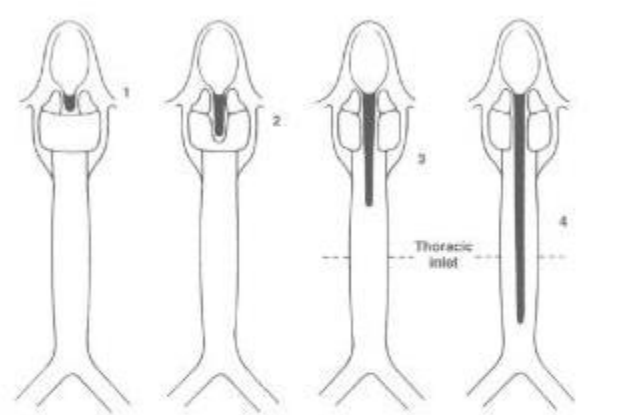
Medela Special Needs Feeder (Haberman)

Laryngeal Cleft



Benjamin and Inglis' original classification. Leboulanger and Garabédian Orphanet Journal of Rare Diseases 2011 6:81

- A type 1 laryngeal cleft is a gap that is located above the vocal cords. This is the mildest form.
- A type 2 laryngeal cleft extends below the vocal cords into the lower cartilage of the voice box.
- A type 3 laryngeal cleft extends beyond the voice box and into the trachea (windpipe).
- A type 4 laryngeal cleft extends even further down into the windpipe, and may go all the way to the bottom of the trachea. This is the most severe form.

https://www.mpenta.org/learning-center/common-problems/laryngeal-cleft/

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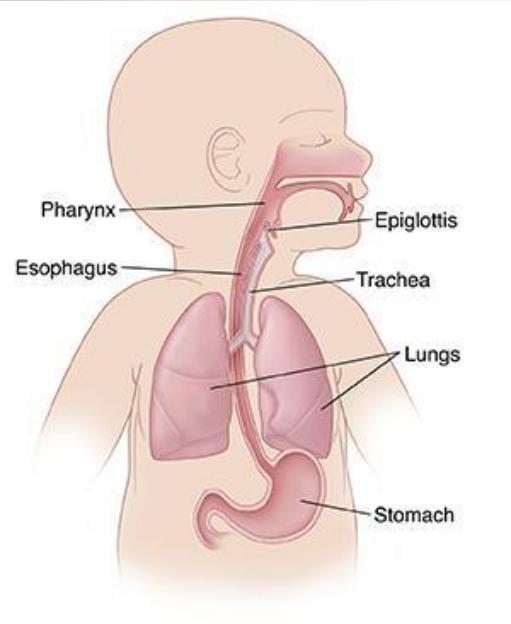
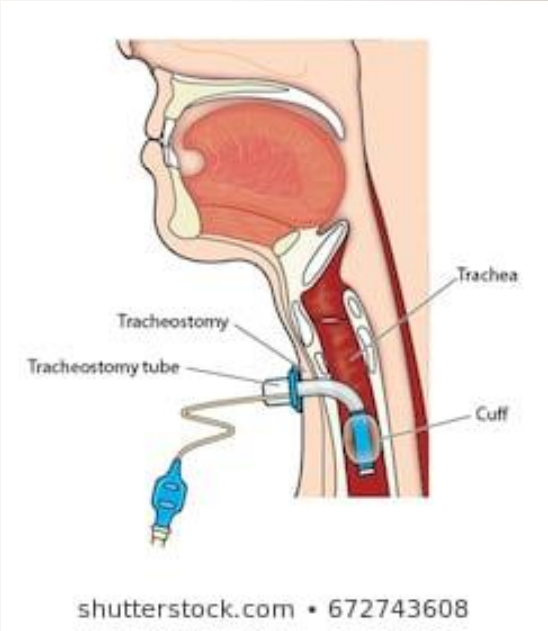
Laryngeal Cleft

Laryngeal Cleft

Tracheostomy



https://www.fairview.org/sitecore/content/Fairview/Home/Patient-Education/Articles/English/u/n/d/e/r/Understanding_Aspiration_Child_90425



https://www.shutterstock.com/search/tracheostomy

Tracheostomy

https://complexchild.org/articles/2016-articles/may/evalee-journey/

Lung Disease & Tracheostomy

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Oral Aversion

- Common for NICU infants
- Negative experiences within the NICU can result in maladaptive feeding behaviors and refusal
- Negative oral-motor stimulation
  - Feeding tube placement (NGT), intubation, supplemental oxygen, suctioning, etc.
- Volume driven culture

Oral Stimulation

Table I. Oral stimulation program

Structure	Stimulation steps	Purpose	Frequency	Duration
Cheek	1. Place index finger at the base of the nose. 2. Compress the tissue, move finger toward the ear, then down and toward the corner of the lip (ie, C pattern). 3. Repeat for other side.	Improve range of motion and strength of cheeks, and improve lip seal.	4× each cheek	2 min
Upper lip	1. Place index finger at the corner of the upper lip. 2. Compress the tissue. 3. Move the finger away in a circular motion, from the corner toward the center and to the other corner. 4. Reverse direction.	Improve lip range of motion and seal.	4×	1 min
Lower lip	1. Place index finger at the corner of lower lip. 2. Compress the tissue. 3. Move the finger away in a circular motion,from the corner toward the center and to the other corner. 4. Reverse direction.	Improve lip range of motion and seal.	4×	1 min
Upper and lower lip curl	1. Place index finger at center of lip. 2. Apply sustained pressure, stretchdownward toward the midline. 3. Repeat for lower lip-apply sustained pressure, and stretch upward toward the midline.	Improve lip strength, range of motion, and seal	2× each lip	1 min
Upper gum	1. Place finger at the center of the gum, with firm sustained pressure slowly move toward the back of the mouth. 2. Return to the center of the mouth. 3. Repeat for opposite side.	Improve range of motion of tongue, stimulate swallow, and improve suck.	2×	1 min
Lower gum	1. Place finger at the center of the gum, with firm sustained pressure slowly move toward the back of the mouth. 2. Return to the center of the mouth. 3. Repeat for opposite side.	Improve range of motion of tongue, stimulate swallow, and improve suck.	2×	1 min
Internal cheek	1. Place finger at inner corner of lips. 2. Compress the tissue, move back toward the molars and return to corner of lip. 3. Repeat for other side.	Improve cheek range of motion and lip seal.	2× each cheek	2 min
Lateral borders of the tongue	1. Place finger at the level of the molar between the side blade of the tongue and the lower gum. 2. Move the finger toward midline, pushing the tongue towards the opposite direction. 3. Immediately move the finger all the way into the cheek, stretching it.	Improve tongue range of motion and strength	2× each side	1 min
Midblade of the tongue	1. Place index at the center of the mouth. 2. Give sustained pressure into the hard palate for 3 seconds. 3. Move the finger down to contact the center blade of the tongue. 4. Displace the tongue downward with a firm pressure. 5. Immediately move the finger to contact the center of the mouth at the hard palate.	Improve tongue range of motion and strength, stimulate swallow, and improve suck.	4×	1 min
Elicit a suck	1. Place finger at the midline, center of the palate, gently stroke the palate to elicit a suck.	Improve suck, and soft palate activation.	N/A	1 min
Pacifier	1. Place pacifier in mouth.	Improve suck, and soft palate activation	N/A	3 min

Fucile, S., Gisel, E., & Lau, C. (2002). Oral stimulation accelerates the transition from tube to oral feeding in preterm infants. *The Journal of pediatrics*, *141*(2), 230-236.

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NICU Stress

- Stress during feeding in the NICU could lead to future aversions, well after the baby has gone home.

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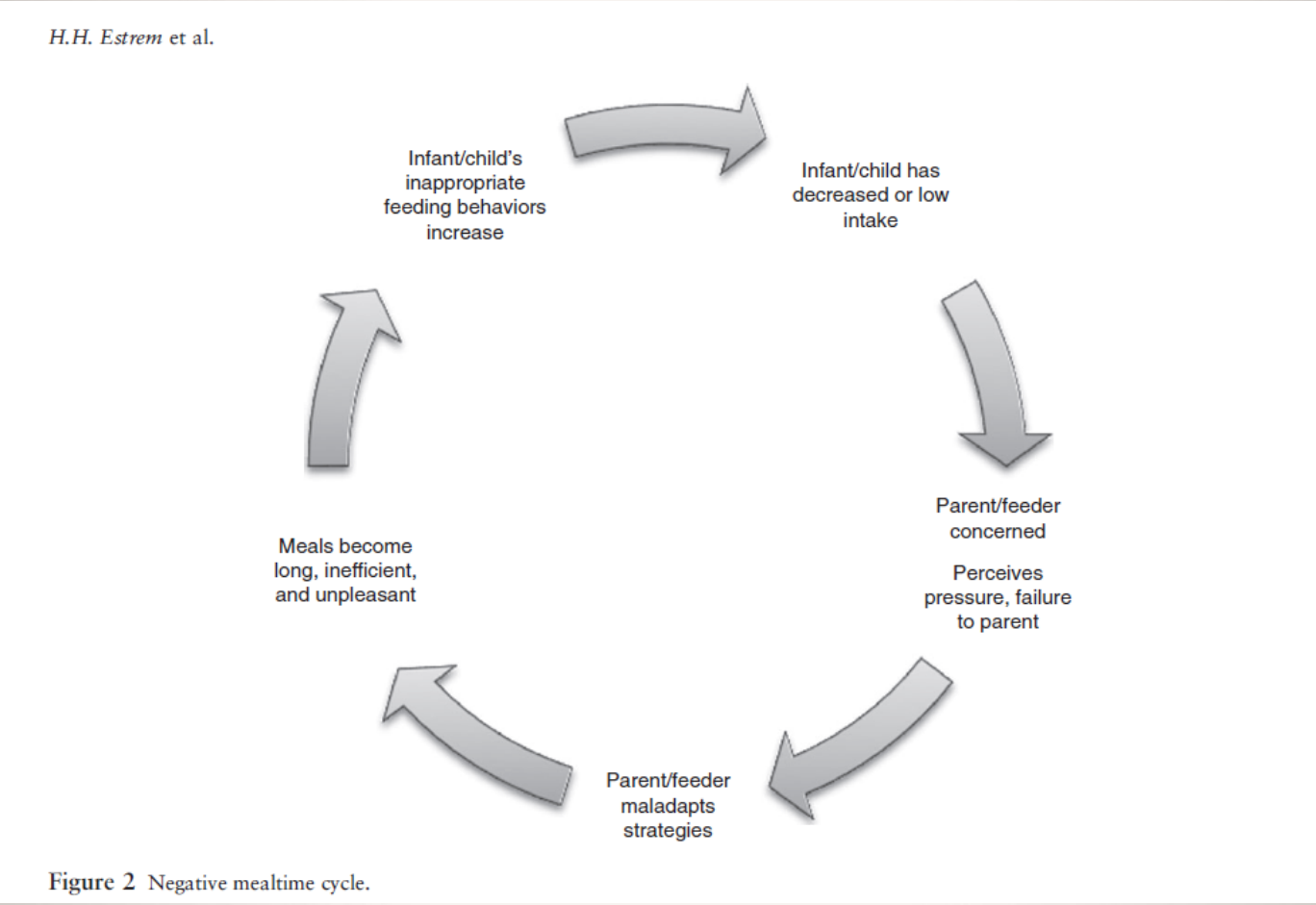
Negative Mealtime Cycle:
Estrem et al., 2016



Estrem, Pados, Park, Knafl, and Thoyre (2016)

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Oral Aversion (and Tracheostomy)

More Clinical Presentations

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Down Syndrome

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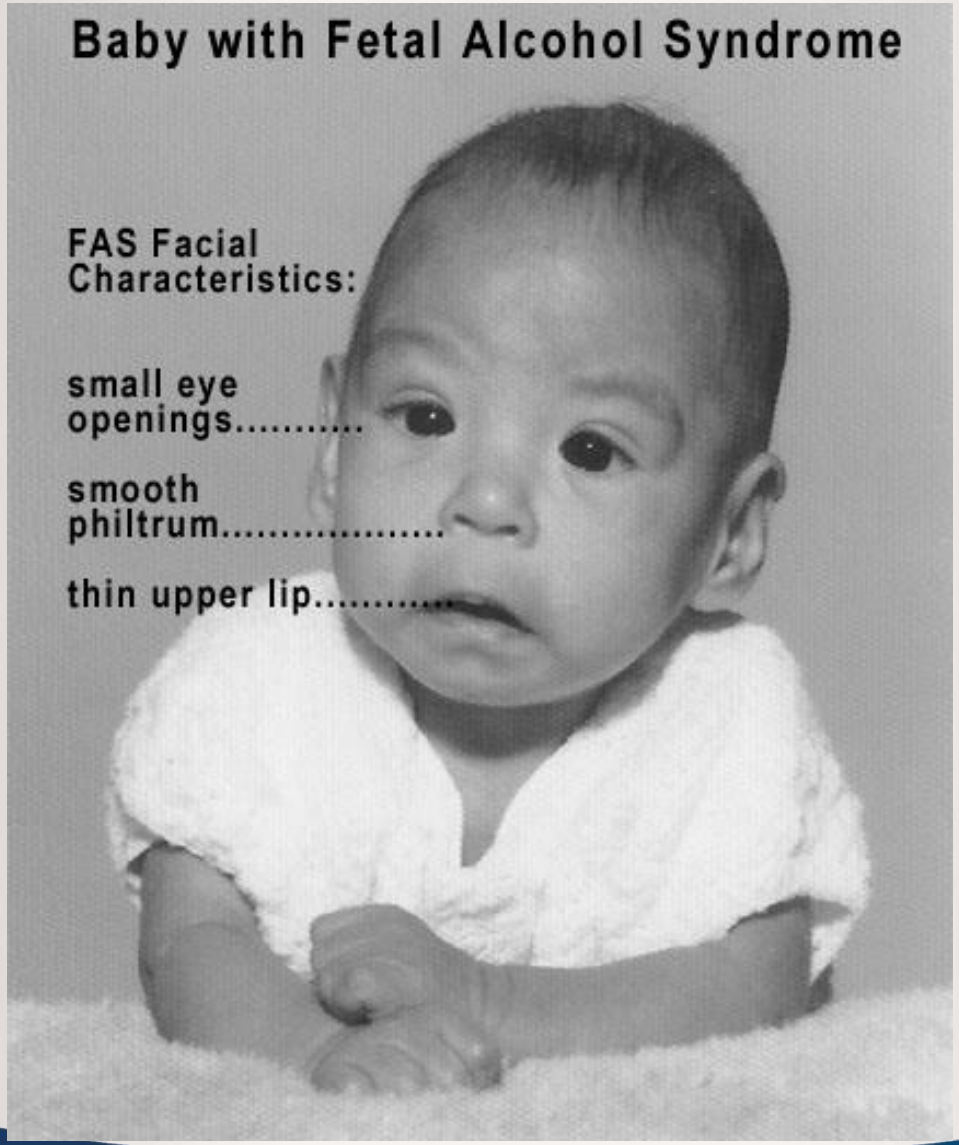
Baby with Fetal Alcohol Syndrome
FAS Facial Characteristics:
small eye openings.....
smooth philtrum.....
thin upper lip.....

Neonatal Abstinence Syndrome

- Every ~15 minutes, 1 baby is born suffering from opioid withdrawal.

http://www.mblynchfirm.com/opioid-lawsuit/opioid-pregnancy/neonatal-abstinence-syndrome/

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Approximately 31% of NICU graduates will experience feeding difficulties prior to one year of age.

Approximately 20% of NICU graduates will experience continued feeding difficulties at the age of 1 to 2 years (Hoogewerf et al., 2017)

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Post-Discharge Care

- Could be sent home totally orally feeding
- Sometimes sent home with tube feeding (either NGT or G-tube)
- Regardless, likely will require follow-up at a feeding clinic
  - Will provide families lists of feeding clinics and ask physicians to make referrals
- Early intervention recommendations

40% of children in feeding clinics are former preterm infants (Lau, 2006)

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Overcoming Obstacles in the NICU

- NICU Culture
  - Quantity versus Quality
    - Volume driven culture
  - Resistance to change
  - Various disciplines involved
- What we can do
  - Remember the infant's best interest is the number one priority
  - Be prepared to support with research/evidence
  - Consistency is important for everyone!
    - Feeding plans (Ross and Brown)

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Final thoughts

- Approximately 31% of NICU graduates will experience feeding difficulties prior to one year of age.
- Remember volume does not equal success.
- Babies are continuously wiring their brains. We want to limit stress and make them future successful feeders.
- Always be mindful of the stress the family is feeling during this time.

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Feeding Matters

www.feedingmatters.org

- https://www.youtube.com/watch?v=Ed1SIfgvC-o

Questions?

Kisabel1@hfhs.org
Eboguth1@hfhs.org

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