Feeding and Swallowing in the Neonate

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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
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
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

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.
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...)

[Image of healthcare professionals in a medical setting]
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
Weeks 9-12
- Facial features, limbs, fingers and toes present
- CNS is functioning
- Hard and soft palate fuse

Weeks 13-16
- Sex organs form
- Skeleton begins to ossify
- Pharyngeal swallow is developing
- **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
<table>
<thead>
<tr>
<th>Reflex</th>
<th>Stimulus</th>
<th>Behavior</th>
<th>Cranial Nerves Involved</th>
<th>Present at</th>
<th>Diminishes By</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gag</td>
<td>Touch to posterior tongue or pharynx</td>
<td>Mouth opening, head extension</td>
<td>IX (glossopharyngeal)</td>
<td>26-27 weeks gestation</td>
<td>Continues throughout adulthood</td>
<td>May or may not be related to swallowing ability. Hyper or hyporesponse may indicate neurological problem</td>
</tr>
<tr>
<td>Phasic Bite</td>
<td>Touch/stimulation to the gums</td>
<td>Rhythmic up and down jaw</td>
<td>V (trigeminal)</td>
<td>28 weeks gestation</td>
<td>9-12 months of age</td>
<td>Precursor to mastication</td>
</tr>
<tr>
<td>Transverse</td>
<td>Stroking lateral surfaces of the tongue</td>
<td>Tongue moves toward the side of</td>
<td>XII (Hypoglossal)</td>
<td>28 weeks gestation</td>
<td>6 months of age</td>
<td>Precursor to lateralization</td>
</tr>
<tr>
<td>Tongue</td>
<td>Touch to anterior tongue</td>
<td>Tongue protrudes from mouth</td>
<td>XII (Hypoglossal)</td>
<td>38-40 weeks gestation</td>
<td>6 months of age</td>
<td>To prepare infant to eat. Important to diminish to introduce spoon feeding.</td>
</tr>
<tr>
<td>Protrusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooting</td>
<td>Stroking infant’s check/mouth</td>
<td>Infant turns head toward</td>
<td>V (trigeminal) VII (facial) XI (Accessory) XII (Hypoglossal)</td>
<td>32 weeks gestation</td>
<td>3 months of age</td>
<td>May be present longer in breast-fed infants</td>
</tr>
<tr>
<td>Reflex</td>
<td>Stimulus</td>
<td>Behavior</td>
<td>Cranial Nerves Involved</td>
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</tr>
<tr>
<td><strong>Grasp</strong></td>
<td>Place index finger in infant’s palm. Gently press.</td>
<td>Infant grasps finger</td>
<td>V (Trigeminal), VII (Facial), IX (Glossopharyngeal), XII (Hypoglossal)</td>
<td>Birth to 2 months of age</td>
<td>4-6 months of age</td>
<td>For finger feeding and holding cup, spoon and bottle</td>
</tr>
<tr>
<td><strong>Babkin</strong></td>
<td>Apply deep pressure to infants palm</td>
<td>Infant opens mouth, closes eyes and brings head forward</td>
<td>Birth</td>
<td>3 months of age</td>
<td>To bring hand to mouth, Receive food into oral cavity</td>
<td></td>
</tr>
</tbody>
</table>

- **Suckling**: Place nipple in mouth, stroke tongue or touch to hard palate
- **Sucking**: Same as suckling
- Up &down tongue movement. Smaller vertical jaw excursion. Jaw moves more independently
- Cranial Nerves: V (Trigeminal), VII (Facial), IX (Glossopharyngeal), XII (Hypoglossal)
- Movement should be rhythmic. Two types: Nutritive-nutritional intake and non-nutritive oral gratification

<table>
<thead>
<tr>
<th>Movement Type</th>
<th>Description</th>
<th>Birth Stage</th>
<th>Age Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palomental</td>
<td>Touch infant’s palm</td>
<td>Birth</td>
<td>3 months of age</td>
<td>To bring hand to mouth</td>
</tr>
<tr>
<td>Startle</td>
<td>Sudden movement backward or presentation of loud noise</td>
<td>Birth</td>
<td>3 months of age</td>
<td>Persistence interferes with infants ability to bring hands to mouth</td>
</tr>
<tr>
<td>Asymmetrical tonic neck (ATNR)</td>
<td>Turn infants head to one side</td>
<td>Birth to 4 months of age</td>
<td>4-6 months of age</td>
<td>Also known as “fencer’s” position. Persistence affects infant’s ability to bring hands to midline and grasp and regard object at same time</td>
</tr>
<tr>
<td>Moro</td>
<td>Sudden head drop backwards</td>
<td>28 weeks gestation</td>
<td>5-6 months of age</td>
<td>To “break up” predominant flexion postures at birth. Persistence may delay acquisition of head control.</td>
</tr>
</tbody>
</table>
**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.
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)
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

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
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
Types of Feeding

- TPN: Total Parenteral Nutrition
- Bottle Feeding
- Breast Feeding
- Any combination
Medical conditions that may affect feeding

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

- Large head compared to face
- Tall forehead with narrow temples
- Wide-spaced eyes (hypertelorism)
- Downward slant of palpebral fissures
- Epicanthal folds
- Short, broad nose with depressed root and full tip
- Deeply grooved philtrum
- Full lips with high, wide peaks to the vermillion border of upper lip
- Small chin and short neck
- Oval-shaped, low-set, posteriorly rotated ears with thick helix
- Excess nuchal skin
- Swollen edematous dorsum of hands and feet
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
## Feeding Readiness Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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 |

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/Bs 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

NEUROPROTECTION

- Partnering with families
- Optimizing nutrition
- Healing environment
- Positioning & handling
- Protecting skin
- Safeguarding sleep
- Minimizing stress & pain

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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/
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

What can we do to help infants during feeding?

- Non-nutritive Intervention
- Pacing
- Positioning
  - Sidelying
  - Semi-upright
  - Upright

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

<table>
<thead>
<tr>
<th>Brand</th>
<th>Standard Preemie Flow</th>
<th>Standard Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nipple price: $2-3 per unit</td>
<td>Nipple price: $2-3 per unit</td>
</tr>
<tr>
<td>Dr. Brown’s</td>
<td>Bottle price: $5-7 per bottle</td>
<td>Highly reliable flow rate across nipples</td>
</tr>
<tr>
<td>Tommee Tippee</td>
<td>Feeding Bottle Slow Flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nipple price: $6-8 per unit</td>
<td>Bottle price: $6-8 per bottle</td>
</tr>
<tr>
<td></td>
<td>Highly reliable flow rate across nipples</td>
<td></td>
</tr>
<tr>
<td>Avent</td>
<td>Classic Newborn Flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nipple price: $5-10 per unit</td>
<td>Bottle price: $7-10 per unit</td>
</tr>
<tr>
<td></td>
<td>Moderately reliable flow rate across nipples</td>
<td></td>
</tr>
<tr>
<td>Playtex</td>
<td>Ventaire Wide Slow Flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nipple price: $4-6 per unit</td>
<td>Bottle price: $4-6 per unit</td>
</tr>
<tr>
<td></td>
<td>Moderately reliable flow rate across nipples</td>
<td></td>
</tr>
<tr>
<td>Nuk</td>
<td>Slow Flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nipple price: $2-3 per unit</td>
<td>Bottle price: $2-3 per unit</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Brand</th>
<th>Slow Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enfamil</td>
<td>Nipple price: $2 per unit</td>
</tr>
<tr>
<td></td>
<td>Bottle price: $1 per unit</td>
</tr>
<tr>
<td></td>
<td>Moderately reliable flow rate across nipples</td>
</tr>
<tr>
<td>Evenflo</td>
<td>Slow Flow</td>
</tr>
<tr>
<td></td>
<td>Nipple price: $1-2 per unit</td>
</tr>
<tr>
<td></td>
<td>Bottle price: $2-4 per unit</td>
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<tr>
<td></td>
<td>Moderately reliable flow rate across nipples</td>
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<tr>
<td>Similac</td>
<td>Wide Base Slow Flow</td>
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<tr>
<td></td>
<td>Nipple price: $2 per unit</td>
</tr>
<tr>
<td></td>
<td>Bottle price: $2 per unit</td>
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<tr>
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</tbody>
</table>
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
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).

Instrumental Evaluation of Swallowing

- Videofluoroscopic Swallowing Study
- Fiberoptic Endoscopic Evaluation of Swallowing
Example VFSS

• What happens during VFSS

• Normal swallowing in Neonate

• Aspiration

• Structural abnormality

Example FEES

• FEES
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
Pierre Robin
Pierre-Robin Syndrome
Jaw distraction surgery (mandibular distraction)

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

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

- **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
- **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 increased 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

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*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
Medela Special Needs Feeder (Haberman)
Laryngeal Cleft

- 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/
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/
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>
<thead>
<tr>
<th>Structure</th>
<th>Simulation steps</th>
<th>Purpose</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
</table>
| Check     | 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 (o, C pattern).  
3. Repeat for other side. | Improve range of motion and strength of cheeks, and improve lip seal. | 4× each check | 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 the 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 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 | 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 check range of motion and lip seal. | 2× each check | 2 min    |
| Lateral | 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 | 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.  
2. Pacifier | Improve suck, and soft palate activation. | NA | 1 min    |

NICU Stress

- Stress during feeding in the NICU could lead to future aversions, well after the baby has gone home.
Negative Mealtime Cycle:
Estrem et al., 2016

Figure 2. Negative mealtime cycle.
Oral Aversion (and Tracheostomy)
More Clinical Presentations
Down Syndrome
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.
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)
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)
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)
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.
Feeding Matters
www.feedingmatters.org

WE ARE SPEARHEADING THE EFFORT TO CONQUER PEDIATRIC FEEDING STRUGGLES THROUGH A CONSORTIUM OF THOUGHT LEADERSHIP.

watch our video

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

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Eboguth1@hfhs.org
References

References

References

References

- Shaker, C. (2013, May). NICU swallowing and feeding: In the nursery and after discharge. Lecture conducted in
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