Providing SLP Services in Pediatric Acute Care and Medical settings

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STEADFAST FAMILY CHILDREN’S HOSPITAL
The participant will gain knowledge and understanding of SLP services in the areas of pediatric acute care and medically based services.

The participant will apply concepts, skills and knowledge learned in the area of speech pathology to better understand the role of an SLP in pediatric acute care and medically based services.
AGENDA
OVERVIEW OF SERVICES PROVIDED

• Cleft Palate and Craniofacial Clinic
• Multidisciplinary Behavioral Feeding Clinic
• Pediatric Acute Care Services
• Aerodigestive Clinic
• NICU
• Pediatric Texture Swallow Study/VFSS/MBS
Cleft Lip and Palate

- what is it?
- incidence
- cause

Congenital Syndromes or Genetic Sequences associated Cleft lip and palate

- 22q11.2 deletion syndrome/DiGeorge Syndrome or
- Velo-cardio-facial
- Charge Syndrome
- Pierre Robin Sequence
- Van der Woude Syndrome...

CLEFT PALATE AND CRANIOFACIAL CLINICS
Cleft Palate and Craniofacial Teams

- Otolaryngologist
- Plastic Surgeon
- Dentist/Orthodontist
- Oral Maxillary Facial Surgeon
- Speech Pathologist
- Audiologist
- Social work
- Genetics

Craniofacial may also include
- Neurosurgeon

CLEFT PALATE AND CRANIOFACIAL CLINICS
Clinical Manifestations of cleft palate

- respiratory concerns (OSA, associated cardiac issues)
- feeding difficulty (bottle/breast, transitioning to solids, nasal regurgitation)
- hearing deficits
- speech and language difficulties
- resonance and airflow disorders
- vocal distortions
- dental issues/malocclusions
- psychosocial impact on the individual and family
Speech Pathologist Role

- Assess PO feeding
- Feeding and swallow difficulty due to
  - difficult latch
  - poor inefficient suck
  - nasal regurgitation
  - small retracted jaw limiting airway
  - poor coordination or respiration and swallowing
  - early fatigue

- Swallow study if indicated
  (coughing/choking, wet congested breathing, desaturations, apnea/bradycardia..)
Dr Brown’s Specialty Feeding System
Haberman Feeder
Enfamil Cleft Lip and Palate Nurser
Pigeon Cleft Palate Feeder
CLEFT PALATE AND CRANIOFACIAL CLINICS

Speech Pathologist Role

0-6 months: Assess PO feeding (bottle/breast)
1-3 years: PO feeding/swallowing - transition to solids
- cup drinking
Speech and Language – pre-language skills, speech sound repertoire, babbling, expressive vocabulary
- Goldman-Fristoe Test of Articulation
Resonance – in connected speech
Voice
Fluency
4 – 7 years: Speech and Language – GFTA developmental errors, compensatory errors and obligatory errors
Resonance evaluation and assessment of velopharyngeal closure to provide information to the team to
determine need for VPI surgical intervention
- auditory perception
- mirror for nasal fogging (American English Sentence Sample)
- nasometry
- videofluoroscopy
- videostroboscopy
Psychosocial impact of speech and resonance impairment (Velo VPI Effects on Life Outcomes)
Communicate with treating therapists in AEA or private local therapists
6-12 years: Articulation developmental, compensatory and obligatory errors

- Resonance - auditory perception, nasal fogging on mirror, nasometry (American English Sentence Sample)
- Voice
- Fluency
- Psychosocial impact (Velo VPI Effects on Life Outcomes)

12 years: Articulation compensatory and obligatory errors

- Resonance – auditory perception, nasal fogging on mirror, nasometry (American English Sentence Sample)
- Voice
- Fluency
- Psychosocial impact (Velo VPI Effects on Life Outcomes, Parent and Youth)
Teaming Meeting

- each discipline discusses results of evaluations
- integrate information to determine next steps
  surgeries (VPI, dental, fistula repairs, bone grafts..)
  therapies or other referrals
  interim follow up with specific disciplines
  determine follow up with team
QUESTIONS ABOUT CLEFT CLINIC?
Pediatric Feeding Disorders are characterized by chronic feeding difficulties including swallowing problems, disruptive mealtime behaviors and rigid food preferences. PFD can result in nutritional compromise and failure to master age or developmentally appropriate feeding skills. (Gosa et al, 2020, Goday et al 2019)

Incidence: 45 % of typically developing children
80 % of children with developmental disabilities and complex medical conditions

(Dharmara et al 2023)
Pediatric Feeding Disorder

Impaired oral intake that is not age-appropriate and is associated with at least one dysfunctional domain: medical, nutritional, feeding skills, and/or psychosocial (World Health Organization International Classification of Functioning, Disability and Health (Dharmaraj et al, 2023)

<table>
<thead>
<tr>
<th>A. A Disturbance in Oral Intake of Nutrients, Inappropriate for Age, Lasting at Least Two Weeks, and Associated with One or More of the Following:</th>
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<tbody>
<tr>
<td><strong>Medical dysfunction</strong></td>
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<td><strong>Nutritional dysfunction</strong></td>
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<td><strong>Feeding skill dysfunction</strong></td>
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**B. Absence of the cognitive processes consistent with eating disorders and pattern of oral intake is not due to a lack of food or congruent with cultural norms.**
PEDIATRIC FEEDING DISORDER

Child
- Underlying diagnosis
- Comorbidities
- Neurodevelopmental status
- Oral and oral feeding experiences
- Type and severity of swallow dysfunction

Age or Timing of Exposure
- Growth and developmental (motor and cognitive)
- Aspiration and effects on lung development
- Optimal nutrition for development neuroplasticity

Environment/Social Influences
- Impact of child/caregiver relationship
- Feeding techniques
- Access to healthcare and appropriate therapies
- Cultural background
- Other psychosocial factors
MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

Team Includes:
Gastroenterology and nurse coordinator
Behavioral Psychology
Speech Pathology
Dietician

May also include: Social Work, Occupational Therapist, Physical Therapist
MUTLIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

ROLES

Gastroenterologist - growth, medical assessment and needs, GI system function, management of NG or G-tube care/change

GI Nurse - assists with prescriptions, accessing WIC

Dietician - growth, BMI and weight gain; caloric needs

Speech - oral motor and feeding and swallowing skills; sensory skills or aversions

Psychologist - behavioral aspects of feeding, relationship between caregiver and child; cultural relationship, feeding experiences
WHO?

- Gastrostomy (g-tube) or naso-gastric (ng-tube) dependent, regardless of a diagnosis of gastroesophageal reflux disease (GERD)
- Malnutrition, or failure to thrive nutritionally
- History of esophageal surgeries
- Food allergies, including eosinophilic esophagitis
- Suspected or diagnosed micronutrient deficiency
- Oral aversion, or a picky eater
- Choking, gagging, or vomiting when eating
- Oral motor and sensory issues
- Feeding difficulties or feeding disorders
MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC
EVALUATION

Medical Assessment
- past medical history
- assess growth history and head circumference
- developmental history
- assessment of NG or G-tube
- labs
- GI system function and habits
- assess for food allergies or intolerance

Nutrition Assessment
- weight, length/height, BMI and growth history
- assess caloric intake and nutrients
- estimates of energy and protein intake

Psychosocial Assessment
- mealtime environment and routines
- interactions between child and caregiver
- assess for psychiatric conditions
- mealtime behaviors
- cultural meal practices
- Family stressors and perception of the problem

Feeding skills Assessment
- Oral motor
- Handling of secretions
- Swallowing function, need for Modified Barium Swallow Study
- Developmental feeding skills
- Behaviors – compensatory, sensory
- positioning and seating
MULTIDISCIPLINARY BEHAVIORAL PEDIATRIC FEEDING CLINIC

INTERVENTIONS/RECOMMENDATIONS

Team Based Recommendations
▲-provides comprehensive plan to treat all areas
▲-avoiding duplication of services

**GI doctor** – treatment of GI conditions (GERD, constipation, EoE…)

**Dietician** – provides nutritional plan for adequate growth and development and manage enteral feedings

**Behavioral Psychologist** – provide behavioral strategies and interventions, referral for additional behavioral or developmental assessment, child-caregiver relationship and mealtime conflict interventions

**Speech Pathologist** – determine safest and most efficient mode or diet for adequate nutrition/hydration, further assessment of swallowing, interventions for swallow dysfunction, interventions for feeding skills development; interventions for sensory aversion, provide appropriate postural support recommendations
QUESTIONS ABOUT PFD OR MULTIDISCIPLINARY FEEDING CLINIC?
PEDIATRIC ACUTE CARE
Role of SLP

- Assess swallow function and risk of aspiration
- Make diet recommendations
- Assess communication – need for AAC to communicate acute care needs (i.e., prolonged intubation but awake)
- Assess communication, cognitive and language deficits
- Assess voice changes
- Tracheostomy
  - assess swallow function
  - communication
  - readiness for speaking valve
PEDiatric ACUTE CARE

Pediatric Intensive Care Unit PICU
  - post extubation swallowing
  - tracheostomy/ventilator
  - acute communication needs

General Pediatric Units
Cancer Unit
Neonatal Intensive Care Unit NICU
Post extubation dysphagia

- 29% of pediatric patients exhibit swallow difficulty
- Laryngeal edema with weakness and decreased sensation
- Dyssynchronous breathing and swallowing
- Poor secretion management
- Possible laryngeal injury, oropharyngeal trauma, reflux muscular weakness

▶ Increased risk for infants and young children as the feeding and swallowing is not fully developed. Interruption during a critical developmental stage of feeding development causing maladaptive oral motor learning and oral aversion.

▶ Every hour of intubation increases the odds of dysphagia by about 50% each day

(Poffmeister et al. 2019)
Tracheostomy and Ventilator Dependence

**Tracheostomy Tube** – curved tube that is inserted through an incision in the trachea to create an artificial airway

**Ventilator** – machine that helps deliver oxygen to a patient and may also help to remove carbon dioxide on exhale

Research has shown dysphagia in up to 93% of patients with tracheostomy with studies showing 94% with aspiration and 50-82% of aspiration detected was silent

- creates an open system with absence of subglottic pressure
- changes in sensation, decreased strength of swallow, difficult elevating the larynx and decreased relaxation of the UES
- need for instrumental assessment (MBS, FEES) due to high incidence of silent aspiration

**Passy-Muir Speaking Valve** - one-way valve placed on the hub of the trach tube redirect airflow through the vocal folds, mouth and nose:

- enabling communication
- restores positive airway pressure and sensation for improved swallowing and section management
- PMV In-line with patients with tracheostomy requiring mechanical ventilation

PEDIATRIC ACUTE CARE
Traumatic Brain Injury (TBI) – swallow function, trach/vent, cognitive linguistic assessment

Cardiac – post extubation swallowing, inefficient feeding due to cardiorespiratory effort; vocal cord paresis or paralysis (RLN) during cardiac surgery

Failure To Thrive – efficiency of PO feeding, swallowing and need for instrumental

Viral or respiratory Illness – post extubation, oral aversion, feeding stamina/efficiency, risk of aspiration and need for instrumental

Cancer – swallowing, oral aversions, communication, cognitive-linguistic changes

Neurological disease (e.g., HIE, CVA, tumors..) and disorders

Airway or respiratory anomalies – assess swallow and risk of aspiration, efficiency of feeding, tracheostomy

Medically complex patients (Neurological or Genetic disorders..) – feeding/swallowing, trach/vent

PEDIATRIC ACUTE CARE
PICU cardiac patient EB-76 do

- previously healthy full-term infant
- admit with multiple episodes of vomiting, listlessness, and increased work of breathing; supraventricular tachycardia with HR into 230s
- cardiac arrest with 25 min of CPR; placed on ECMO and intubated for 9 days then weaned to NCPAP then NC and speech consulted 6 days after extubation

Results: initial consult no PO readiness cues, difficulty managing secretions, weak hoarse cry; take

2 days later stronger cry and voice although still hoarse, accepting tastes and demonstrating increased interest

3 days later stronger interest in PO and stronger cry; ready for swallow study

**Results of MBS:** decreased latch and strength of suck, decreased coordination or respiration and swallowing with increased work of breathing and delayed laryngeal closure resulting in intermittent laryngeal penetration with fatigue. Started PO feeds 2x/day for 10 min

Over next 2 days he did well and increased PO feeds to 4x/day for 10 min over the next two weeks PO feeds gradually increased and on return visit was taking full feeds and the NG tube had been removed
CASE STUDY #2

18 yo male; motorcycle hit by pickup truck, found unresponsive on the road, no helmet. GCS 3; arrived intubated with numerous maxillofacial injuries, intraparenchymal hemorrhage with greatest insult to the R frontal lobe, bilateral pelvic fractures, left femoral dissection, multiple leg fractures/injuries and pulmonary contusions. Developed acute respiratory failure due to Pneumonia and unable to wean from the vent; trach and PEG tube placed by OTO on

Day 23. Day 2 of tracheostomy started trach collar trials to wean from the vent

Day 35 Speech consult for AAC

Day 38 rec’d consult for swallow eval and PMV; tol trial 10 min weak voice increased WOB; ice chips

Day 41: re-assess with PMV; tolerated 10 min; weak voice although increased voicing with cues REC: start PMV with supervision working up to 1 hour;

Day 52 decannulated

Day 56: completed initial MBS with open trach stoma; Rec ice chips and water trials

Day 70 (2 weeks after initial MBS) repeat MBS; RECS: started on cup diet with thin liquids; single sips with chin tuck and head turn to the left; throat clear every couple of sips and re-swallow; continued GJ tube feeds

Day 72: left for inpatient rehab

Day 122: follow up with Nutrition; still requiring GJ feeds but drinking most of his formula; eating solids by mouth (PB crackers, burritos, chips, meat, potatoes, rice, MCDonalds; discharged from outpatient PT/OT/Speech
QUESTIONS ABOUT ACUTE CARE?
AERODIGESTIVE CLINIC

Addresses the specific needs of children with complex multi-system problems affecting the respiratory and upper gastrointestinal tracts.

Provides comprehensive coordinated evaluation and management of complex conditions of upper airway, lungs and upper digestive tract.

Focus on children with a combination of multiple and interrelated congenital and/or acquired conditions affecting airway, breathing, feeding and swallowing and concerns about growth and nutrition.

(Boesch, et al, 2018)
Core Aerodigestive Team Members
- Pediatric Otolaryngologist (ENT)
- Pediatric Pulmonologist
- Pediatric Gastroenterologist
- Speech Language Pathologist

Other Specialty Team Members
- Cardiology or Cardiothoracic Surgery
- Allergy/Immunology
- Sleep Medicine
- Genetics
- Pediatric Surgery
- Dietician
- Respiratory Therapy
- Social Work
AERODIGESTIVE CLINIC

COMMON AERODIGESTIVE PROBLEMS AMONG SUBSPECIALISTS

Otolaryngology
- Strider
- Noisy Breathing
- Recurrent Croup
- Epiglottic inflammation
- Laryngeal Cleft
- Laryngeal stenosis
- Laryngomalacia
- Vocal cord paralysis
- Tracheal Stenosis
- Laryngeal webs
- Airway obstruction
- Obstructive Sleep Apnea
- Velopharyngeal dysfunction

Gastroenterology
- Esophageal motility disorders
- Gastroesophageal reflux disease
- Esophageal structural disorder (TEF, EA, strictures, web, hiatal hernia, vascular ring..)
- Eosinophilic Esophagitis
- Feeding Intolerance
- Malnutrition or Failure to Thrive
- Feeding Tube Dependence

Pulmonology
- Chronic cough
- Wheezing
- Recurrent Pneumonia or Recurrent Upper Respiratory Infections
- Tracheomalacia
- Bronchomalacia
- Chronic Lung Disease
- Cardiopulmonary Disease

Speech Pathology
- Feeding difficulties and disorders
- Excessive drooling
- Dysphagia
- Aspiration
- Voicing difficulties
- Communication
AERODIGESTIVE CLINIC

DIAGNOSTICS

- ENT – flexible laryngoscopy, neck x-ray
- Pulmonologist – chest x-ray, chest CT, bronchoalveolar lavage
- Gastroenterologist – UGI, esophagram, impedance pH
  - monitoring, mucosal endoscopic assessment, esophageal manometry
- Speech Therapist – clinical evaluation of oral motor, feeding and swallowing, FEES with ENT, MBS, voice assessment, PMV assessment
- Sleep Study – obstructive sleep apnea, central sleep apnea
- Triple scope – direct rigid laryngoscopy and bronchoscopy, flexible bronchoscopy, Esophagogastroduodenoscopy EGD
INTERVENTIONS

- Comprehensive plan is developed based on data collected from all disciplines
- Surgical – laryngeal cleft repair, Supraglottalplasty, airway reconstruction, vocal fold injections, dilation of the airway, esophageal dilations, Nissen procedure, G-tube placement...
- Pharmacological – reflux medication, medication for excessive drooling, pulmonary medications
- Diet modifications- change in formula or food avoidance for food sensitivities and intolerances, modifications of texture or thickening liquids due to feeding or swallowing difficulties and aspiration; calorie boosting or supplemental nutrition
- Alternate mode of nutrition/hydration – aspiration, inefficient or inadequate PO intake, FTT
CASE STUDY -- LJ

- **28w0d twin B**, IUGR, left heart failure; VSD; prolonged intubation and multiple re-intubations, , severe BPD, Pulmonary HTN, hydronephrosis with urinary obstruction; slow to work up to full enteral feed

- **Day of life 136 (47w3d)** Start PO feeds at Phase 1; on NCPAP RAM cannula 6 cm H2O

- **Day of life 150 (49w3d)** speech consult; rec swallow study due to PO on NCPAP and congestion/cough with PO

- **Dol 163 (51w6d)** swallow study; immediate moderate-severe aspiration with all nipple flows

- **Repeat swallow study DOL 172** moderate silent aspiration thin with deep penetration with mildly thick

- **DOL 175 (53w0d)** discharged from the hospital with full NG tube feeds on NC 1.5 L 100% O2

- **4 weeks later (6 m 4 m CA)** repeat swallow study silent aspiration of thin, consistent deep pen with mildly thick and 1 episode of mild pen with moderately thick; start with spoon tastes 1x/day continue NG tube feeds

- **Repeat swallow study 10m (7 m CA)**; NC 1.0 L mod-severe feeding and swallowing impairment; referral to ENT for airway eval due to chronic aspiration; still with NG feeds plan for G-tube

- **ENT saw 1 months later- FLL WNL good B VF movement; suspected laryngeal cleft plan for DL/B**

- **13 mo DLB** identified Type Laryngeal cleft with laryngeal cleft injection; G-tube placed; referred to AERO clinic

- **12 m Feeding clinic and repeat swallow study** All aspiration was silently with no attempts to clear. ; rec continue G-tube feeds; offer thick puree spoon

- **16 m AERO** clinic ENT wet junky cough; recent aspiration pneumonia after emesis, drooling; started solids 1x/day family reports improvement since cleft injection plan for triple scope plan for permanent cleft repair GI–suspect esophagitis; plan for EGD started Omeprazole Pulmonology baseline O2 needs due to chronic lung disease unable to wean started started Flovent and cont albuterol; triple scope planned

- **18 mo triple scope** permanent cleft repair, EGD with biopsies, flexible bronchoscopy and bronchoalveolar lavage

- **20 m repeat swallow study**: improvement noted started drinking moderately thick liquids from trainer cup **Follow up AERO**: O2 weaned to ½ L, PO feeding going well; biopsy results from EGD showed minimal esophagitis cont with reflux med; chronic congestion improved follow up in AERO in 4 months
QUESTIONS ABOUT AERODIGESTIVE CLINIC?
SPEECH PATHOLOGY IN THE NICU
ORAL FEEDING AND THE NICU

The knowledge and skills specific to serving infants within the NICU environment focus on communication, cognition, feeding, and swallowing in the developing infant within the context of the family.

Knowledge required:

• Normal embryology, perinatal, and postnatal infant development
• Atypical infant development which includes theories and research findings, risk factors in prenatal and perinatal development, etiologies, and medical conditions.
• Family-centered practices including the impact of the NICU experience on family dynamics and function, information about family systems, parent-infant interactions, parent empowerment, and meaningful professional alliances.
• Team-based processes

Specialized knowledge is also needed in the following areas:

• Foundations of developmentally supportive care (e.g., synactive theory, behavioral state organization).
• Medical complications affecting infants as well as the medical equipment and procedures used in the NICU.
• Staffing patterns in the NICU.
• Ecology of the NICU.
• Parenting in the NICU.

(ASHA, 2004)
FEEDING AND THE NICU

THE EXPERIENCE OF LEARNING TO FEED IN THE NICU MAY PREDISPOSE PRETERM INFANTS TO FEEDING PROBLEMS THAT PERSIST WELL BEYOND DISCHARGE.

STUDIES HAVE SHOWN THAT MORE THAN 50 % OF PARENTS OF NICU GRADUATES REPORT PROBLEMS FEEDING AT THE AGE OF 18-24 MONTHS
FEEDING – COMPLEX DYNAMIC PROCESS

PHYSIOLOGICAL STABILITY IS CONSIDERED THE FOUNDATION FOR ORGANIZING:

MOVEMENT
BEHAVIORAL STATE
ATTENTION/INTERACTION
SELF-REGULATION

ORGANIZATION OF THESE SUBSYSTEMS IS THE FOUNDATION FOR SAFE AND EFFICIENT FEEDING

(GOLDFIELD ET. AL; SHAKER, 2017)
FEEDING AND NEURODEVELOPMENT

• FEEDING REQUIRES INTEGRATION, MATURATION AND COORDINATION OF THESE SYSTEMS WHICH IS OBSERVED THROUGH:
  
  SUCK/SWALLOW/BREATH COORDINATION
  MAINTAINING PHYSIOLOGICAL STABILITY
  SUSTAINING ATTENTION TO THE TASK
  CONTROLLING AND COORDINATING POSTURAL, ORAL AND UPPER AIRWAY MOTOR SYSTEMS
  PROTECTING AIRWAY FROM FLUID

• BEHAVIORS DURING FEEDING ARE A DIRECT REFLECTION OF THE INTERACTIONS OF THESE SUBSYSTEMS AND NEED TO BE INTERPRETED FROM THAT PERSPECTIVE
  
  -COMPENSATORY BEHAVIORS OR STRESS CUES ARE A MEANS TO ACHIEVE OR MAINTAIN STABILITY
FOSTERING NEUROPROTECTION DURING FEEDING

- EARLY FEEDING EXPERIENCES CAN EFFECT THE BRAIN OF THE DEVELOPING PRETERM - DEVELOPING MOTOR AND SENSORY PATHWAYS AND THOSE THAT ARE USED EITHER POSITIVE OR NEGATIVE ARE REINFORCED WHILE UNUSED PATHWAYS ARE PRUNED

- EXPERIENCE OF LEARNING TO FEED IN THE NICU MAY PRE-DISPOSE PRETERM INFANTS TO FEEDING PROBLEMS THAT PERSIST BEYOND THE NICU LONG AFTER DISCHARGE TO HOME (SHAKER 2017)
FOSTERING NEUROPROTECTION/NEURODEVELOPMENT

• PROVIDE INTERVENTIONS THAT PROMOTE STABILITY AND AVOID ONSET OF MALADAPTIVE BEHAVIORS DURING FEEDING

• PROVIDE POSITIVE INTERACTIONS DURING FEEDING
  
  READING BEHAVIORAL CUES
  SUPPORT COPING SKILLS
  DECREASE STRESS
  OFFERING POSITIVE EXPERIENCES

• FOCUS ON THE QUALITY OF THE FEED- MOVING AWAY FROM VOLUME DRIVEN CULTURE
INFANT DEVELOPMENT

❖ 1-8 weeks (embryo)
  ▶ major structures forming
  ▶ Beginning of facial, oral cavity and pharyngeal development
  ▶ Taste buds evident at 7 weeks and some mature by 12 weeks

❖ 9-12 weeks (fetus)
  ▶ Completion of facial, oral and pharyngeal structures
  ▶ Pharyngeal swallow can be seen at 10-11th weeks of fetal life

❖ 13-16 weeks
  ▶ Suckling response may be elicited
INFANT DEVELOPMENT

- 17-20 weeks
  - True suckling response with forward and backward motion of the tongue

- 21-25 weeks gestation
  - By 24 weeks lungs produce surfactant
  - Suckling response continues but mature pattern/rhythm not developed
INFANT DEVELOPMENT

- 26-29 weeks
  - Difficulty breathing air, nervous system is maturing
  - Standard of practice (SOP) >= 29 weeks gestation may begin gustatory stimulation “Milk in Mouth” under certain conditions
    - Non-intubated, non-sedated
    - 0.5-1 ml by small syringe
    - Monitor tolerance and document responses
## NICU ORAL FEEDING

### Pre-Feeding Readiness

<table>
<thead>
<tr>
<th>Touch</th>
<th>Smell</th>
<th>Taste: Initiate if baby is rooting</th>
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<tbody>
<tr>
<td>Skin to skin with parents</td>
<td>Held skin to skin by mother</td>
<td>Nuzzling at pumped breast</td>
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<tr>
<td>Held by caregiver</td>
<td>Breast milk on baby’s fingers with hands to face</td>
<td>Breast milk on baby’s fingers or pacifier with hands to mouth</td>
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<tr>
<td>Hands to face &amp; mouth</td>
<td>Breast milk on upper lip</td>
<td>Milk on pacifier with bolus feeds for patient ≥ 29 weeks, non-intubated, &amp; non-sedated</td>
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4/8/2024
INFANT DEVELOPMENT

❖ 30-34 weeks--potential for feeding begins
  - SOP supports babe presented to breast as early as 33 weeks gestation under certain conditions
    ▶ Appropriate expectations need to be communicated to mother/family

❖ NICU SOP >= 33 weeks, show signs of feeding readiness (rooting, finger sucking, mouthing) and medically able can attempt oral feeding in a cue based feeding protocol
  ▶ appropriate expectations communicated to family
  ▶ feeding readiness does not mean full PO feeds, gradual process of learning
  ▶ looking at introductory level sills
INFANT DEVELOPMENT

❖ 34 weeks
  ▶ Some medically stable infants born at 34 weeks can feed well enough to grow
  ▶ May or may not require some nutrition via NG (nasogastric) tube but more likely than not will need some supplemental nutrition

❖ 35-40 weeks
  ▶ 38-42 weeks gestation is considered is "term" and if otherwise medically stable and stable from a respiratory standpoint should be able to feed well enough to grow

4/8/2024
INFANT DEVELOPMENT

Infants who were born prematurely do not necessarily meet the same developmental milestones as if they were a full-term infant

- Sleep/wake cycles
- Feeding abilities
- Breathing
- Responses

➢ A 37 weeks GA infant although considered full term does not equal a 40 week term infant
➢ An infant born at 32 weeks that is now 40 weeks does not equal a full term 40 week infant; prematurity counts
INFANT DEVELOPMENT

- Medical conditions may delay introduction of oral feeding including
  - cardiac
  - pulmonary
  - GI
  - other
GUIDELINES TO INITIATE ORAL FEEDING

Medical Readiness

- Patients must be at least 33 weeks PMA
- Off mechanical ventilations, NP-CPAP, and NAVA
- Respiratory support level of RAM < 6, HFNC < 2, Nasal Cannula, or Room Air
- Must be tolerating enteral feedings infused over 1 hour or less
- Able to maintain their own secretions
- Have a gag reflex
- Must be tolerating enteral feedings infused over 1 hour or less
INFANT GUIDED FEEDING

• PROMOTE POSITIVE FEEDING EXPERIENCE
• CO-REGULATION BETWEEN CAREGIVER AND INFANT FORMS THAT FOUNDATION FOR POSITIVE INFANT FEEDING
• CONTINGENT INTERVENTIONS
• OBSERVING MOMENT TO MOMENT DURING FEEDING FOR CUES OF STRESS VERSUS STABILITY SPECIFIC TO SWALLOWING, BREATHING, PHYSIOLOGICAL STABILITY, POSTURAL CONTROL AND STATE REGULATION
• CONTINUOUSLY MODIFYING THE FEEDING APPROACH THROUGH INDIVIDUALIZED INTERVENTIONS CONTINGENT ON THE INFANT’S BEHAVIORAL CUES (SHAKER, 2017; DOWLING, 1999)
INFANT GUIDED FEEDING  
(CUE BASED FEEDING)

- Research has shown that the ability to feed well is closely related to the caregiver’s ability to understand and respond to the infant’s physiological and behavioral communication cues.

- “Mom, you got this” feeding is communication. When we help NICU caregivers interpret what their preemie is telling them during feeding, we support the parent-infant relationship.

- Volume is not the goal.
INFANT GUIDED FEEDING (CUE BASED FEEDING) AND PARENT/CHILD RELATIONSHIP

INFANT FEEDING OFFERS ONE THE EARLIEST OPPORTUNITIES TO SUPPORT THE CONNECTION BETWEEN PARENT AND THE INFANT

• PROMOTED THROUGH POSITIVE FEEDING INTERACTIONS

  INTERACTION DURING FEEDING AIDS IN THE DEVELOPMENT OF SOCIAL INTERACTION, COMMUNICATION AND BEING RESPONSIVE TO OTHERS BETWEEN BOTH PARENTS AND THE INFANT

  - RECOGNIZING THE STRESS OF PARENTS WITH AN INFANT IN THE NICU

  - EMPOWERING PARENTS TO HELP DEVELOP THE FEEDING RELATIONSHIP FOR BONDING AND ATTACHMENT

• POSITIVE FEEDING EXPERIENCE FOR THE INFANT AND FOR THE FEEDER
  • FOR INFANT—AVOID UNDUE STRESS, ALLOW FOR SUPPORTED FEEDING EXPERIENCE, AVOID NEGATIVE EXPERIENCES
  • FOR FEEDER—CARING AND NURTURING ENVIRONMENT, PROVIDING ADEQUATE SUPPORT, AVOIDING FRUSTRATION

• PROMOTES POSITIVE NEURODEVELOPMENT

  (SHAKER, 2017; GEORGE ET AL. 2008)
WHAT & WHY CUE BASED FEEDINGS?

WHAT:
- Cue based feedings are scheduled feedings where oral attempts are based on infant readiness cues.
- And responding to cues for infant guided feeding during the feeding and responding to cue for when to stop the feed

WHY:
- Supports successful coping of preterm/term infants.
- Promotes communication and attachment.
- Connects infant behaviors to consequences; teaches him that he can affect his environment.
- Supports brain development.
- Provides pleasurable feeding experiences for infants – prevent long term negative outcomes – oral aversion
- Decreases to the time to full feeds
INFANT CUES

- Tell us about
  - When to start and when to end feeding
  - When to pause
  - Milk flow
  - Ability to tolerate bolus size
  - Optimal length of sucking burst,
  - Need for postural support
  - Need for assisting with state change
  - When coordination is no longer synchronized
### Infant Feeding Readiness Scale

A scale used to evaluate the oral feeding readiness at each attempt

<table>
<thead>
<tr>
<th>Score</th>
<th>Behavior Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alert and/or fussing before care; rooting and/or bringing of hands to mouth/taking of pacifier; shows infant stability</td>
<td>FEED</td>
</tr>
<tr>
<td>2</td>
<td>Initially drowsy then alert once handled; rooting or taking of pacifier; adequate tone and infant stability</td>
<td>FEED</td>
</tr>
<tr>
<td>3</td>
<td>Briefly alert with care; no hunger behaviors; no change in tone and has infant instability</td>
<td>DO NOT FEED</td>
</tr>
<tr>
<td>4</td>
<td>Sleeps throughout care; no hunger behaviors; no change in tone and/or has infant instability</td>
<td>DO NOT FEED</td>
</tr>
<tr>
<td>5</td>
<td>Needs increased oxygen with care; apnea and/or bradycardia with care; tachypnea greater than baseline with care, increased infant instability</td>
<td>DO NOT FEED</td>
</tr>
</tbody>
</table>
FEEDING SEQUENCE
FEEDING SEQUENCE

Pre-Feeding

<table>
<thead>
<tr>
<th>Pre-Feeding Readiness</th>
<th>Touch</th>
<th>Smell</th>
<th>Taste: Initiate if baby is rooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin to skin with parents</td>
<td>Held skin to skin by mother</td>
<td>Nuzzling at pumped breast</td>
<td></td>
</tr>
<tr>
<td>Held by caregiver</td>
<td>Breast milk on baby’s fingers with hands to face</td>
<td>Breast milk on baby’s fingers or pacifier with hands to mouth</td>
<td></td>
</tr>
<tr>
<td>Hands to face &amp; mouth</td>
<td>Breast milk on upper lip</td>
<td>Milk on pacifier with bolus feeds for patient ≥ 29 weeks, non-intubated, &amp; non-sedated</td>
<td></td>
</tr>
</tbody>
</table>

Skill

Suck ➔ Swallow ➔ Breath

3 Breathing Patterns:
1. Suck, Suck, Suck, Forget to breath
2. Suck, Suck, Breathe, Breathe, Breathe, Suck, Suck, Suck
3. Suck, Breathe, Suck, Breathe, Suck, Breathe

Sucking Rhythm and Sucking Burst
FEEDING SEQUENCE

Can they consume the amount in the time frame?

Goals:
1. Maintain alert state
2. Maintain energy
3. Maintain oral-motor tone

Sucking burst of 20-30 sucks seamlessly integrating breathing with sucking and swallowing.

Goals:
1. Full Coordination and ability
2. Demands to be feed
3. Enjoyment of eating
GETTING READY FOR A FEEDING

- **Assess readiness** – physiological stability
- **Facilitate calm/alert state**
  - Calm if agitated by swaddling (providing boundaries and support)—leave hands at midline at face
  - Awake if sleepy/sleeping
    - Gradually increase light and sound in room
    - Loosen swaddling
    - Attempt to elicit rooting reflex
    - Non-nutritive sucking with gloved finger or pacifier
- Offer pacifier to support readiness/organization and stability
- Offer PO only if **respiration is stable** under 60 and maintaining saturations
- Offer PO only if **maintaining awake and alert state**
POSITIONING AND HOLDING

- Infant should be well supported
  - Chin, hands, flexed hips, knees midline
- Elevated sidelying position
  - Similar to breast feeding positions
  - Supports better respiratory movements
  - Helps with loss of flow
FEEDING STRESS CUES

CHANGE IN ENERGY
- CHANGE IN STATE OF ALERTNESS – FALLING ASLEEP WITH FEEDS
- CHANGE IN POSTURAL CONTROL OR TONE AND MOVEMENT PATTERNS
- DISINTEREST IN FEEDING

CHANGE IN BEHAVIOR
- EYEBROW RAISE
- EYELID FLUTTER
- FURROWED BROW
- WORRIED LOOK
- MOVING AWAY FROM NIPPLE
- EXTENDING FINGERS OR ARMS
- PUSHING NIPPLE AWAY

CHANGE IN CARDIO-RESPIRATORY BEHAVIOR:
- COLOR CHANGE FROM BASELINE (PALLOR, CYANOSIS)
- RESPIRATORY FATIGUE
- TACHYPNEA
- NASAL FLARING AND/OR BLANCHING
- CHIN TUGGING/PULLING HEAD BACK
- SHALLOW SHORT BREATHS INSTEAD OF A SERIES OF DEEP BREATHS
- UNSTABLE SATURATIONS
- BRADYCARDIA, APNEA
- COLOR CHANGE FROM BASELINE (PALLOR, CYANOSIS)
- RESPIRATORY FATIGUE
- TACHYPNEA
- NASAL FLARING AND/OR BLANCHING
- CHIN TUGGING/PULLING HEAD BACK
- SHALLOW SHORT BREATHS INSTEAD OF A SERIES OF DEEP BREATHS
- UNSTABLE SATURATIONS
- BRADYCARDIA, APNEA
FEEDING STRESS CUES (CONT’D)

UNCOUPLING OF SWALLOWING AND BREATHING REFLECTED IN:

- Loss of bolus control orally (“drooling”)
- Gulpig
- Gurgling sounds in the pharynx
- Multiple swallows to clear bolus
- Coughing and/or choking
Infants must have a PMA > 33 weeks, meet medical readiness, and meet Guidelines to Initiate Oral Feeding to begin Oral Feeding Advancement Guidelines

<table>
<thead>
<tr>
<th>PHASE</th>
<th>Feeding Advancement</th>
<th>Oral Support During non-PO feeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Breastfeed or bottle feed 2 times per calendar day without adverse effects</td>
<td>• Skin-to-Skin</td>
</tr>
<tr>
<td></td>
<td>• Feeding must be non-consecutive (i.e. not 2 in a row)</td>
<td>• Held during bolus</td>
</tr>
<tr>
<td></td>
<td>• When intake of each offered feeding is greater than 75% without increased</td>
<td>• Hands to face</td>
</tr>
<tr>
<td></td>
<td>infant instability, for 48 hours advance to the next phase</td>
<td>• Milk drops on fingers, hands, and/or lips</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nuzzling at pumped breast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Milk on pacifier with bolus feed</td>
</tr>
<tr>
<td>2</td>
<td>• Breastfeed or bottle feed 4 times per calendar day without adverse effects</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>• Feedings may have 2 consecutive attempts if cueing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• When intake of each offered feeding is greater than 75% without increased</td>
<td></td>
</tr>
<tr>
<td></td>
<td>infant instability, for 48 hours advance to the next phase</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>• Breastfeed or bottle feed 6 times per calendar day without adverse effects</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>• If feed 3 consecutive feedings in a row, then administer the fourth feeding via</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tube</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• When intake of each offered feeding is greater than 90% without increased</td>
<td></td>
</tr>
<tr>
<td></td>
<td>infant instability, for 48 hours advance to the next phase</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>• Breastfeed or bottle feed all feedings without adverse effects</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td>• Minimum volume per 24 hour shift established for growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• When volume minimum met for 48 hours patient is Ad Lib and NG may be removed</td>
<td></td>
</tr>
</tbody>
</table>
**WHEN TO CALL SPEECH PATHOLOGY??**

<table>
<thead>
<tr>
<th>Evaluation of Oral Sensory/Motor and Swallowing Status with the Goal of Assessing Readiness to Feed Prior to Initiating Feeding</th>
<th>Evaluation of Feeding/Swallowing Evaluation Treatment Is Appropriate for Infants With the Following Feeding Issues:</th>
</tr>
</thead>
</table>
| • History of ECMO  
• Tracheostomy  
• Oral feeds introduced after 36 weeks postmenstrual age (PMA) (Infants < 1000 grams/< 26 weeks estimated gestational age (EGA))  
• Grade III or IV intraventricular hemorrhage  
• Periventricular leukomalacia  
• Progressive hydrocephalus  
• Absent or poor swallow requiring frequent suctioning of secretions  
• Absent or weak gag or cry  
• Vocal cord paralysis or paresis  
• Airway abnormalities  
• History of hypoxic-ischemic encephalopathy (HIE) or other neurological diagnosis  
• Cleft lip and palate | • Inability to latch on and initiate an appropriate suck after 34 weeks PMA.  
• Frequent desaturations during feeding unresponsive to oxygen therapy.  
• Apnea/bradycardia during feeding after 34 weeks PMA.  
• Poor oral intake < 50% of required volume after 36 weeks PMA.  
• Sputtering, coughing, choking, congestion (feedings in the nares or nasal pharynx) during/after feedings.  
• Increased or prolonged infant instability with feedings  
• Failure to progress through oral feeding advancement guidelines  
• Oral aversion: Refusing pacifier, excessive gagging with normal oral stimulation  
• Need for an early feeding skills assessment |
WHERE DO SLPS FIT IN?

• EVALUATION AND TREATMENT OF INFANTS WITH FEEDING/SWALLOWING IMPAIRMENTS

• CLINICAL/BEDSIDE ASSESSMENTS/TREATMENT
  EARLY FEEDING SKILLS ASSESSMENT FOR PRETERM INFANTS

• PEDIATRIC TEXTURE SWALLOW/SUCK-SWALLOW STUDY/OPMS

HTTP://WWW.YOUTUBE.COM/WATCH?V=BSFA31HKEV0

4/8/2024
# Early Feeding Skills Assessment (EFS) Clinical Version:
## EFS, Readiness, Recovery, Conditions

<table>
<thead>
<tr>
<th>Pre-feeding Baseline:</th>
<th>Respiratory Rate</th>
<th>Oxygen Saturation</th>
<th>Heart Rate</th>
</tr>
</thead>
</table>

**Readiness (Immediately Prior to Feeding)**

<table>
<thead>
<tr>
<th></th>
<th>Motor</th>
<th>State</th>
<th>Oral-motor behavior when offered finger or pacifier</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flexed body position with arms toward midline (with or without support) through assessment period</td>
<td>Awake</td>
<td>Actively opens mouth and drops tongue to receive the nipple when lips are stroked</td>
</tr>
<tr>
<td></td>
<td>Loss of flexed position with handling</td>
<td>Drowsy</td>
<td>Opens mouth but does not actively seek the nipple</td>
</tr>
<tr>
<td></td>
<td>Non-flexed body position with arms to sides throughout assessment period</td>
<td>Sleep</td>
<td>Does not open mouth when lips are stroked</td>
</tr>
</tbody>
</table>
DEVELOPMENT

- Non-nutritive suck not always predictive of nutritive suck and feeding performance
- Mature non-nutritive suck
  - 2 sucks per second in runs of variable length depending on infant, state, and environment
  - Should have no respiratory compromise
- Mature nutritive suck
  - 1 suck per second
  - Quality and rate may influenced by flow, taste, hunger, environment, pulmonary status
# EARLY FEEDING SKILLS ASSESSMENT (EFS)

<table>
<thead>
<tr>
<th>Respiratory Regulation</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Each time the nipple is received, transitions to sucking without behavioral or cardio-respiratory instability</td>
<td>Consistently stable</td>
<td>Instability for at least one transition</td>
<td>Instability for most or all transitions</td>
</tr>
<tr>
<td>2. Times the length of the sucking burst to remain stable</td>
<td>Consistently</td>
<td>Occasionally sucks too long before stopping to breathe</td>
<td>Frequently sucks too long before stopping to breathe</td>
</tr>
<tr>
<td>3. Integrates breathing within the sucking burst</td>
<td>Consistently</td>
<td>Attempts to add breaths but is not yet fully integrated</td>
<td>No or rare breaths during the sucking burst</td>
</tr>
<tr>
<td>4. Organizes long sucking bursts (7+ sucks) without signs of behavioral or cardio-respiratory instability</td>
<td>Consistently takes long sucking bursts and remains stable</td>
<td>Occasionally long sucking bursts lead to instability</td>
<td>Frequently long sucking bursts lead to instability OR no long sucking bursts</td>
</tr>
<tr>
<td>5. Increased work of breathing</td>
<td>Never or rarely</td>
<td>Occasionally</td>
<td>Frequently</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oral-Motor Functioning</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Actively opens mouth and drops tongue to receive the nipple when lips are stroked</td>
<td>Consistently</td>
<td>Inconsistent</td>
<td>Never</td>
</tr>
<tr>
<td>7. Promptly starts sucking once nipple is received</td>
<td>Consistently</td>
<td>Inconsistent</td>
<td>Never or rarely</td>
</tr>
<tr>
<td>8. Sucks with steady and strong suction</td>
<td>Consistently</td>
<td>Occasional compression-only sucking</td>
<td>Frequent compression-only sucking</td>
</tr>
<tr>
<td>9. Loss of milk at lips</td>
<td>No or rare loss of milk</td>
<td>Occasional loss of milk</td>
<td>Frequent loss of milk</td>
</tr>
<tr>
<td>Swallowing Coordination</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10. Gurgling/rattle sounds created by fluid in the nose or pharynx</td>
<td>No or rare gurgling</td>
<td>Occasional gurgling</td>
<td>Frequent gurgling</td>
</tr>
<tr>
<td>11. Gulp or effortful hard swallows</td>
<td>No or rare gulping</td>
<td>Occasional gulping</td>
<td>Frequent gulping</td>
</tr>
<tr>
<td>12. High-pitched “yelping” sound when transitioning from swallowing to breathing</td>
<td>No or rare “yelping”</td>
<td>Occasional “yelping”</td>
<td>Frequent “yelping”</td>
</tr>
<tr>
<td>13. Coughing or choking sounds</td>
<td>Never</td>
<td>One event observed</td>
<td>More than one event</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engagement</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. State</td>
<td>Awake</td>
<td>Becomes drowsy late in the feeding</td>
<td>Becomes drowsy early in the feeding</td>
</tr>
<tr>
<td>15. Energy</td>
<td>Sustains motor tone/energy</td>
<td>Late loss of tone/energy</td>
<td>Early loss of tone/energy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physiologic Stability</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Stress</td>
<td>No or rare</td>
<td>Occasional</td>
<td>Frequent</td>
</tr>
<tr>
<td>17. Color change</td>
<td>No color change</td>
<td>Occasional color change</td>
<td>Frequent or prolonged color change</td>
</tr>
<tr>
<td>18. Stable oxygen saturation</td>
<td>Stable, remains close to pre-feeding level</td>
<td>Occasional dips below clinical standards</td>
<td>Frequent or prolonged dips below clinical standards</td>
</tr>
<tr>
<td>19. Stable heart rate</td>
<td>Stable, remains close to pre-feeding level</td>
<td>Occasional rise or dips 20% above or below pre-feeding</td>
<td>Frequent rise or dips 20% above or below pre-feeding</td>
</tr>
</tbody>
</table>

---

a Instability is evidenced by behavioral (eyebrow raise, eyelid flutter, furrowed brow, worried look, moving away from nipple, extending fingers or arms, pushing nipple away) or physiologic cues (apnea, desaturations, heart rate drops).

b Increased work of breathing is evidenced by nasal flaring and/or blanching, chin tugging/pulling head back/head bobbing, suprasternal retractions, grunting/prolonging the exhale, or use of accessory breathing muscles.

c Energy is expressed through motor tone, postural control, midline feeding position, and flexion.

d Eyebrow raise, eyelid flutter, furrowed brow, worried look, moving away from nipple, extending fingers or arms, pushing nipple away
## RECOVERY (Post-feeding)

<table>
<thead>
<tr>
<th>State</th>
<th>Quiet alert</th>
<th>Sleep or drowsy</th>
<th>Restless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy level</td>
<td>Flexed body position with arms toward midline (with or without support)</td>
<td>Period of decreased muscle tone; recovers after short rest</td>
<td>Energy depleted after feeding, loss of tone/energy, flaccid</td>
</tr>
</tbody>
</table>

**Feeding conditions:**

- Feeding skills: _____ maintained across the feeding  _____ improved during the feeding  _____ declined during the feeding
- Amount of supplemental oxygen pre-feeding: ______  Amount of supplemental oxygen during feeding: ______
- Fed with NG/OG tube in place: Yes / No  Type of bottle/nipple used ______________________ Length of feeding (minutes) ___
- Volume consumed ____ cc  Position: cradled ___ semi-elevated side-lying ___ semi-upright in front ___ other ____________

**Recommendations for next feeding:**
**EFS Scoring:** Each subscale is scored individually. Each item can score 1, 2, or 3 with 1 representing the least skill or high frequency of problem (right hand column) and 3 representing mature skill or absence of problem (left hand column). Scores of 2 indicate skills that are emerging/occasionally observed or problems that are occasionally observed. Provide total scores and an “X” in the appropriate box to the right of the total score for each subscale.

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Every item scores “3”</th>
<th>At least one item scores “2”</th>
<th>At least one item scores “1”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Skill is consistently observed</td>
<td>Skill still emerging and/or problem is indicated</td>
<td>Skill not yet evident and/or significant problem is evident</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Total Score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Regulation</td>
<td></td>
<td>5 – 12</td>
</tr>
<tr>
<td>Oral-Motor Organization</td>
<td></td>
<td>4 – 12</td>
</tr>
<tr>
<td>Swallowing Coordination</td>
<td></td>
<td>4 – 12</td>
</tr>
<tr>
<td>Engagement</td>
<td></td>
<td>2 – 6</td>
</tr>
<tr>
<td>Physiologic Stability</td>
<td></td>
<td>4 – 12</td>
</tr>
<tr>
<td><strong>Total EFS</strong></td>
<td></td>
<td>19 – 57</td>
</tr>
</tbody>
</table>
AFTER THE EVALUATION

DETERMINE NEED FOR INSTRUMENTAL ASSESSMENT

• SYNTHESIZE INFORMATION GATHERED AND CLINICAL ASSESSMENT

OR

DEVELOP INDIVIDUALIZED FEEDING PLAN FOCUSING ON:

• FEEDING READINESS
• MAINTAINING PHYSIOLOGICAL STABILITY
• SUPPORTING SUCK/SWALLOW/BREATH
• RECOMMENDATIONS FOR ADVANCING FEEDS

UPON DISCHARGE FROM THE NICU

SPEECH THERAPY FOLLOWS TO FACILITATE ADVANCING TO FULL PO FEEDS

• ADDRESS STAMINA
• SWALLOW
• ORAL AVersions

FOLLOW UP CLINICS

• HIGH RISK INFANT/NICU CLINIC
• MULTIDISCIPLINARY FEEDING CLINIC
• AERODIGESTIVE CLINIC
• GI WITH DIETICIAN VISIT
Questions about NICU?
VIDEOFLUROSCOPIC SWALLOW STUDY
(PEDIATRIC TEXTURE SWALLOW STUDY, MODIFIED BARIUM SWALLOW STUDY VFSS)
DETERMINING NEED FOR INSTRUMENTAL SWALLOW STUDY

High incidence of silent aspiration in infants and young children

Presenting symptoms in infants and young children vary

Clinical evaluation should not always be reassuring in the context of ongoing aerodigestive symptoms (chronic cough, congestion...) or history of respiratory illness

Detailed medical and feeding history is crucial and must be considered in decision-making process

(Duncan et al, 2018; Arvedson et al, 1993)
DETERMINING NEED FOR INSTRUMENTAL SWALLOW EVALUATION

- Coughing/Choking with feeds
- Apnea/Bradycardia
- Desaturations
- Congestion/Wet Breathing
- Sputtering/Gurgling
- Strider or Noise Breathing
- Poor Secretion Management
- Failure to Progress
- Increased Oxygen Requirements
- Multiple Swallows to Clear
- Failure to Thrive
- Cyanosis
- Recurring Respiratory Infections/Illnesses
- Unexplained Recurrent Fears
- Safety of PO prior to initiating feeding therapy for severely impaired

High risk conditions
- Tracheostomy
- Vocal fold paresis/paralysis
- Airway abnormalities (TEF, laryngomalacia, laryngeal cleft...)
- Neurological impairments
- Genetic Disorders (PRS, Down Syndrome, DiGeorge Syndrome, Cleft palate..)
- Need for ECMO
- Prolonged Intubation
VFSS VS FEES

VFSS

➢ Objective assessment of all the phases of swallowing in the correlation of the phases
➢ Able to evaluate for silent aspiration during all phases of the swallow
➢ Objective assessment of aerodigestive function and coordination (suck-swallow-breath); visualization of all 3 phases
➢ Able to objectively test and identify therapeutic options
➢ Can help identify abnormal A&P (Ie.) Malacia, cleft palate, laryngeal cleft, etc
➢ Objective assessment of aerodigestive function and coordination (suck-swallow-breath)
➢ Visual feedback for patient’s families

FEES

➢ ABILITY TO VISUALIZE VOCAL FOLDS
➢ ASSESSING BREASTFEEDING
➢ VISUALIZATION OF SPECIFIC LEVELS OF AIRWAY PROTECTION (laryngomalacia, epiglottis, VF)
➢ MANAGEMENT OF SECRETIONS
➢ SPECIALIZED SENSORY TESTING when applicable
➢ NO EXPOSURE TO RADIATION- can repeat as needed without concern of radiation exposure
➢ LONGER CONTINUOUS OBSERVATION
VFSS IMAGE WITH STRUCTURES LABELED. A: SOFT PALATE; B: BASE OF TONGUE; C: VALLECUA; D: EPIGLOTTIS; E: LARYNGEAL VESTIBULE; F: UES (UPPER ESOPHAGEAL SPHINCTER) G: PYRIFORM SINUSES; H: TRACHEA

(OLSON-GREB, BK, 2020)
Infants and growth

ANATOMY AND PHYSIOLOGY OF INFANT SWALLOW CHANGES OVER TIME WITH GROWTH AND DEVELOPMENT

- Newborns flexed tucked position, larynx is tucked under the chin,
- Infants swallow is reflexive ruled by the brainstem
- Flexion with no hyolaryngeal elevation

STRUCTURE AND FUNCTION - Change is structure demands and change in function

4-6 MONTHS
- Reflexes disappear and cortical control involvement
- Larynx starts moving toward adult position increasing need for hyolaryngeal elevation
- Soft palate no longer approximates the epiglottis and there is a progression of epiglottic displacement for airway protection

6-12 MONTHS
- Cortical control development of the motor strip and the brain becomes more organized for further feeding development skills (ie chewing)
- Stored sensory experiences signal properties signal to control the bolus (if something is hard then we chew...), motor response to perceive sensory properties
As anatomy changes the physiology gradually changes
- Oral cavity enlarges
- Pharynx elongates
* Need more active control to direct the bolus and protect the airway

12 months to 3 years transitional stage
- Mix of infant and more adult like patterns

3 years to 5 years
- Hyolaryngeal excursion increases especially reaching adult like around years

Approximates adult around the age of 5 years
(Kua et al, 2006)
MEDICAL AND SWALLOWING HISTORY
- NATURE OF THE PROBLEM AND CONCERNS ABOUT SWALLOWING
- GENERAL MEDICAL HISTORY
- TIMING AND DURATION OF ONSET OF SYMPTOMS
- CHARACTERISTICS OF THE FEEDING/SWALLOWING DIFFICULTY
- HISTORY OF WEIGHT GAIN AND GROWTH
- HISTORY OF RESPIRATORY ILLNESS
- OTHER CONTRIBUTING FACTORS

TYPICAL FEEDING PATTERNS - utensils, consistencies, feeders

DETERMINE TYPICAL POSITION FOR FEEDING

DISCUSS THE PROCEDURE WITH THE FAMILY/CHILD

ORAL MOTOR EXAM

ASSESSMENT OF SECRETION MANAGEMENT

PRIOR TO THE STUDY
SET UP AND PROCEDURES

► POSITION
  * SIMULATE NATURAL FEEDING POSITION AS MUCH AS POSSIBLE
  * HEAD, NECK AND TRUNK SHOULD BE FULLY SUPPORTED

► SUPPORTS NEEDED – SUPPLEMENTAL O2, CARDIAC, RESPIRATORY MONITORS

► UTENSILS - BOTTLES WITH SPECIFIC NIPPLE FLOWS AND OPTIONS, SPECIAL CUPS, SIPPIE CUPES, SPECIAL UTENSILS

► VISCOSITES
VFSS SHOULD TEST THE FULL RANGE OF DEVELOPMENTALLY APPROPRIATE CONSISTENCIES. ADDITIONALLY, IT IS IMPORTANT THAT THE VISCOSITY OF THE FLUIDS TESTED DURING VFSS MATCHES WHAT IS RECOMMENDED TO THE PATIENT.

STANDARDIZED SET OF BARIUM CONTRAST -LEVELS 0-4 ON THE IDDSIM SULFATE CONSISTENCIES HAVE BEEN DEVELOPED AND ARE SPECIFICALLY USED FOR VFSS.

(MARTIN-HARRIS ET AL, 2017; CICHERO ET AL, 2017)
PRESENTATION OF CONTRAST

**MBSIMP** – PROTOCOL FOR INTRODUCTION OF CONTRAST AND BOLUS SIZE FOR ADULTS AND OLDER CHILDREN

**INFANTS AND YOUNG CHILDREN**

- NOT YET A STANDARD PROTOCOL FOR BOTTLE FED INFANTS;
  BABYVFSSIMP, 5 FUNCTIONAL DOMAINS WITH 24 COMPONENTS
  MARTIN-HARRIS ET AL, 2019

- START WITH WHAT THEY ARE CURRENTLY DOING

- SHOULD OFFER ALL DEVELOPMENTALLY APPROPRIATE VISCOSITIES

**LIMITATIONS**
Information we can obtain from VFSS to determine appropriate interventions:

* Lip closure
* Mastication
* Preparation and Oral Control of the Bolus
* Effectiveness of Oral Transfer
* VeloPharyngeal Function
* Hyolaryngeal Elevation
* Airway Protection/Closure
  - Timing and Completeness of Closure
  - Compression of Supraglottic Structures
  - Epiglottic Inversion
* Timing of Triggering of the Pharyngeal Swallow

* Combination of Events of the Pharyngeal Swallow
* Pooling of Bolsu Material in the Valleculae and Pyriform Sinuses
* Efficiency of Pharyngeal Clering and Presence of Residuals
* Number of Swallows to Clear
* Preseances and Timing of Airway Compromise (Penetration or Aspiration)
* Patient's Response to Airway Compromise
WITH INFANTS

*COORDINATION OF SUCK/SWALLOW/BREATHE

*MORE PRECISE INDICATION OF WOB

*INITIATION OF NUTRITIVE SUCK

*# OF SUCKS TO FORM THE BOLUS

*NUTRITIVE SUCK RHYTHM/ORGANIZATION

*ORAL RESIDUALS AT THE END OF SUCK-SWALLOW SEQUENCE

*SUCK/SWALLOW BOLUS CONTROL
NORMAL INFANT VIDEOFLOUROSCOPIC SWALLOW STUDY
Oropharyngeal swallow disorder

- Delay to the valleculae
- Delay to the pyriform sinuses
- Deep penetration
- Aspiration during the swallow
- Aspiration posterior tracheal wall
# PENETRATION-ASPIRATION SCALE (PAS)

**Eight-point penetration-aspiration scale**

<table>
<thead>
<tr>
<th>1. Material does not enter the airway</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Material enters the airway, remains above the vocal folds, and is ejected from the airway</td>
</tr>
<tr>
<td>3. Material enters the airway, remains above the vocal folds, and is not ejected from the airway</td>
</tr>
<tr>
<td>4. Material enters the airway, contacts the vocal folds, and is ejected from the airway</td>
</tr>
<tr>
<td>5. Material enters the airway, contacts the vocal folds, and is not ejected from the airway</td>
</tr>
<tr>
<td>6. Material enters the airway, passes below the vocal folds, and is ejected into the larynx or out of the airway</td>
</tr>
<tr>
<td>7. Material enters the airway, passes below the vocal folds, and is not ejected from the trachea despite effort</td>
</tr>
<tr>
<td>8. Material enters the airway, passes below the vocal folds, and no effort is made to eject</td>
</tr>
</tbody>
</table>

From Rosenbek et al. [33],
A- No aspiration during swallowing (PAS = 1), B- aspiration (PAS = 8, red arrow shows material below the true vocal folds), C- post swallow residue, D- Nasopharyngeal reflux (green circle), E- Esophagopharyngeal reflux (yellow circle shows bolus material returning to PES and above), F- Nasopharyngeal reflux (green arrow), post swallow residue (blue circle) and aspiration (red arrow) in an infant. Dhaarmaratha, et al, 2020
INTERPRETING DATA FROM THE STUDY:

TESTING FEEDING MODIFICATIONS (ALTERED BOLUS FLOW RATE, MODIFIED CUPS OR SPOONS)

MODIFIED VISCOSITY

CHANGES IN POSTURE/POSITIONING IMPLEMENTATION OF EXTERNAL PACING, COMPENSATORY STRATEGIES

MAKING RECOMMENDATIONS FOR DIET, FEEDING MODIFICATIONS, OR OTHER THERAPEUTIC INTERVENTIONS INDICATED BASED ON THE RESULTS OF THE STUDY.
QUESTIONS ?
THANK YOU

DANIELLE ERICSON HITZEL
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