INTEGRATING PEDIATRIC VFSS RESULTS INTO THERAPY

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Goals of Discussion

- Major developmental changes in pediatric swallow anatomy and physiology
- Role of clinical assessment
- VFSS basics
- Common abnormal pediatric swallow characteristics observable during VFSS
- Possible intervention strategies to facilitate safe feeding in infants/children with dysphagia
- Further assessment options

DEVELOPMENTAL CONSIDERATIONS
Oral Feeding Influences

- Feeder
- Maturity
- Oral-Motor Control
- Neurological Function
- State Regulation
- Muscle Tone
- Structural Integrity
- GI Tolerance
- Respiratory Status
- Sensory Integration
- Endurance

Pre-Requisites to a Strong Clinical Swallowing Evaluation (CSE)

- Foundational knowledge base of typical and abnormal development as it relates to feeding
- Good understanding of child's daily feeding function
- Feeding observation

Pre-Requisites to a Strong CSE

- Foundational knowledge base of typical and abnormal development as it relates to feeding
  - Anatomy
  - Physiology
  - Feeding methods
  - Developmental textural expectations
Developmental Considerations: Infant

- Developmental sequence & connections ("Pinder’s Parallels"): Gross motor, fine motor and oral motor skills develop in parallel
  - Flexion → Extension → Lateral → Rotary movements

- How & what we feed a child is dependent on development:
  - Birth to 4 months: dependent on reflexes:
    - Flexion → Extension
    - Breast Feeding/Bottle
  - 4-6 months: reflexes fade, laryngeal drop:
    - Flexion → Extension → Lateral
    - Breast Feeding/Bottle/cup/spoon
  - 6-12 months: tongue increasingly able to lateralize, diagonal movements start, rotary jaw emerges
    - Flexion → Extension → Lateral → Rotary emerging
    - Breast Feeding/Bottle/Cup/Spoon/Meltables/Soft Chewables

Developmental Considerations: Young Child

- TODDLERS
  - Flexion → Extension → Lateral → Diagonal/Rotation emerging
  - Cup drinking, straw drinking, bottle decreasing
  - Finger foods, soft/chopped table foods
  - Self-feeding attempts
  - Reduced chewing efficiency, impacted by motor demand & attention

- PRESCHOOLERS
  - Flexion → Extension → Lateral → Rotary
  - Cup drinking, straw drinking
  - Finger foods, Table foods
  - Independent self-feeding (albeit still messy)
  - Increased food repertoire
  - Improving chewing efficiency with harder to chew solids

Developmental Considerations: School-Age & Beyond

- Flexion → Extension → Lateral → Rotary Refined rotary chew….with mouth closed!!
- Any mode of drinking
- Any solid food
- Use of all utensils independent

“Learn to speak garrulously and simultaneously eat voraciously with friends yet remain monosyllabic and slouched when dining with immediate family”
~ Wulis & Ryan, 2012
Anatomy Changes: Mouth
- Tongue size & function
  - Tongue positioned entirely within mouth
  - Oral “space” available
  - Quality of lingual movement possible
- Cheek structure
  - Sucking pads in infancy

Anatomy Changes: Pharynx
- Shape/angle
  - Angle of nasopharynx, oropharynx & hypopharynx changes with age
- Spaces
  - Space between epiglottis & the velum increases from infancy to adulthood

Anatomy Changes: Larynx
- Position of the Larynx
  - Infant larynx is superior and anteriorly positioned closer to tongue base as “innate structural defense”
- Neck Elongation / “Laryngeal drop” at ~4 1/2 to 6 months
  - Continuing “drop” as child grows: C6 by 5 yrs; C7 by 15-20 years.
Key Points in Abnormal Development

WITHOUT STABILITY & ORGANIZATION

ORAL STRUCTURES WILL BE USED FOR COMPENSATORY STABILITY

ORAL STRUCTURES WILL NOT BE FREE FOR PRECISE MOVEMENT NEEDED TO HANDLE FOOD/LIQUIDS!

Red Flags for Dysphagia

- Coughing/choking/sputtering during feeds
- Slow feeding [No feeding > 30 minutes]
- Limited volume
- Fatigue Issues
- Volume intolerance
- Inability to coordinate breathing during feeds
  - Increased work of breathing — tachypnea
  - Cessation of breathing — apnea

~ Refer to Wallis & Ryan, 2012

Red Flags for Dysphagia

- Recurrent Upper Respiratory problems
- History of “asthma/allergies”
- Abnormal vocal quality
- Persistent drooling
  - Beyond teething
  - When not learning a new motor skill
### Red Flags for Dysphagia

- Suspicion of poor oral-motor skill development:
  - Weak suck
  - Insufficient oral exploration by baby
  - Inadequate lip closure
  - Poor control as food is moved around in the mouth
  - Inefficient chewing skill development

### Red Flags for Dysphagia

- Slow weight gain and/or sudden weight loss
  - Failure to Thrive
  - Apparent food aversion(s)
  - Transition difficulties between bottle feeding and solid textures by 12 months
  - Extremely narrow “acceptable foods” list (<20)
  - Lack of hunger signals

### Characteristics of Children with Chronic Micro-Aspiration

- First to get sick
- Stay sick longer
- Get sicker than others with same illness
- Stable, but often w/ chronic low grade fever
- Frequently diagnosed with asthma

*“Oropharyngeal dysphagia should be considered in the differential diagnosis of young children presenting with unexplained respiratory problems even if they are without apparent dysphagia risk factors.”*
  
  ~ Lefton-Gregl, Carroll, & Loughlin, 2006
Impact of Aspiration

- Small-volume aspirations (microaspirations) may cause a more chronic and insidious presentation and impact on more distal lung structures.”
  ~Wallis & Ryan, 2012
- “Aspiration can result in almost any pathological endpoint in the lung.”
  ~Wallis & Ryan, 2012

Downward Cycle Towards Eventual Malnutrition

- Inadequate Oral Motor Skills
- Increased Time to Eat
- Increased Fatigue
- Decreased Intake
- Eventual Malnutrition

ROLE OF CLINICAL EXAM
Pre-Requisites to a Strong CSE

- Good understanding of child’s daily feeding function
  - In-depth Caregiver Interview (systems)
  - 3-day food diary: Foods, Amount, Setting, Behaviors, Time

Components to a Strong CSE

- Feeding observation
  - Family dynamics
  - Food selections
  - Child’s approach
  - Utensils used
  - Systems

- Feeding modifications
  - What can you try to improve child’s feeding?

Possible Outcomes from a CSE

- No Treatment Necessary
  “Whew! There is no problem after all!”

- Treatment/Intervention is Warranted
  “There IS a problem; I know how to help!”

- Further Assessment of Swallow is Warranted
  “There IS a problem; I need to know more!”
Potential Candidate for Additional Instrumental Assessment of Swallow if:

- Clinical signs of aspiration on serial clinical swallowing evaluations
- Poor feeding progression with concern for aspiration as contributing factor
- High risk of silent aspiration given underlying medical status
- Medical stability to tolerate procedure

Further Assessment Options for Pharyngeal Phase

- VIDEOFLUOROSCOPIC SWALLOW STUDY (VFSS) or PEDIATRIC MODIFIED BARIUM SWALLOW (PMBS)
- FIBEROPTIC ENDOSCOPIC EXAMINATION OF SWALLOWING (FEES)

Pros & Cons of VFSS

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualize structures</td>
<td>Radiation exposure</td>
</tr>
<tr>
<td>Visualize timing, function, and effectiveness of swallow</td>
<td>Only one moment in time</td>
</tr>
<tr>
<td>Identifies when/if aspiration occurs</td>
<td>Barium!</td>
</tr>
<tr>
<td>Assess the effectiveness of changes during feeding</td>
<td>Not able to assess a baby breast-feeding</td>
</tr>
<tr>
<td>Great parent education tool</td>
<td>Expensive</td>
</tr>
<tr>
<td></td>
<td>Not a natural setting/scary</td>
</tr>
<tr>
<td></td>
<td>Realistic?</td>
</tr>
</tbody>
</table>
Pros & Cons of FEES

ADVANTAGES
- Visualize structures
- Visualize secretion management
- Timing of swallow
- Clearance after swallow
- Assess effectiveness of changes during feeding
- Can assess breastfeeding
- Great parent education tool
- Can visualize benefit
- No radiation exposure
- Any fluid or solids (colored)

DISADVANTAGES
- Can’t visualize laryngeal penetration or aspiration during the swallow
- Has to tolerate placement of scope
- Not a natural setting/scary
- Realistic?
- Expensive

VFSS BASICS

Aim of Pediatric VFSS
- Evaluate anatomy & physiology of swallowing mechanism
  - Confirm anatomic integrity of swallowing structures
  - Identify patterns of abnormal swallowing physiology
  - Assist with differential medical diagnosis
  - Detect consequences of impaired swallowing physiology
- Determine effective therapeutic interventions to enhance swallowing safety
- Not to assess Gastroesophageal Reflux
- Not simply to “rule-out” aspiration
Guidance from CSE for VFSS

- Define questions to be addressed in VFSS
- Determine if child is able to participate and is expected to cooperate
  - Medical readiness
  - Child must have some oral experiences with food or liquid
- Ascertain starting point for VFSS procedure

Rules for Successful Fluoroscopy

- 30 frames per second is recommended standard fluoroscopy setting
- Magnification, Collimation and Coning to show oral, pharyngeal, and laryngeal structures
- Use “As Low as Reasonably Achievable” ALARA principles
  - Shielding
  - Representative (but limited) sampling
  - Fatigue sampling methods

Pediatric Positioning

Sidelying: Infant

Upright: Infant/Toddler

Peladeau-Pigeon & Steele, 2015
Pediatric Positioning

MAMA Chair:
Toddler/Preschooler

Wheelchair/C-Arm:
School-Age/Adolescent

Progression of Modifications

- SLP identifies sequence based on bedside clinical exam
  - Typically, transition from most successful to most challenging
  - Use of infant’s or child’s familiar feeding materials

Radiographic Phases of the Swallow
VFSS Findings: Oral Phase

- Sucking/suckling pattern
- Bolus collection
- Bolus control during movement
- Oral transit time
- Oral clearance
- Oral phase efficiency

VFSS Findings: Pharyngeal Phase

- Timing of the swallow reflex
- Respiratory coordination with the swallow
- Velar function
- Laryngeal elevation and closure during the swallow
- Pharyngeal Esophageal Sphincter (PES) function
- Pharyngeal clearance of the bolus

Delayed Initiation

- Liquid flowing to the pyriform sinus with airway still open prior to swallowing
**Nasal Reflux**

- Liquid goes up into the nasopharynx – soft palate does not close off properly

**Laryngeal Penetration**

- Liquid within the laryngeal inlet, ABOVE the vocal folds

**Aspiration**

- Liquid BELOW the vocal folds
VFSS Findings: Pharyngeal Phase

- Frequency, degree, and timing of any aspiration event
  - Before the swallow
  - During the swallow
  - After the swallow
- Response to an aspiration event
  - Presence & timing of protective cough
  - Effective clearance of aspirate material

VFSS Findings: Esophageal Phase

- “Incidental observations” only
- PES function
- Esophageal transit time
  - Notation as to whether bolus passage is timely, slow, or if any obstruction of bolus flow is noted
- Retrograde movement of contrast witnessed and to what level?
- Important to view at least once (pass over)

VFSS Findings: Fatigue Sampling

- Sample over time
  - Endurance issues frequently have implications on swallow physiology
  - Deterioration in quality of feeding noted as the feed progresses
- Intermittent fluoroscopy to assess consistency of swallow
  - Feedings off-line paired with fluoroscopy
  - Timing of fluoroscopy driven by expected volumes and performance guided by SLP
Swallowing Expectations Change Based on Development

- Increased oral space as child grows:
  - More lingual control required
  - More synchrony of oral motor movements

- Pharyngeal swallow initiation changes with development:
  - Infants trigger at valleculae
  - Toddlers trigger as bolus transitions from mouth

- Loss of innate protection:
  - Laryngeal drop
  - Shift from reflexive to volitional control

Laryngeal penetration significance dependent on:
- Frequency and depth
- Lung health and development

Characteristics of Aspiration:
- Visible on posterior tracheal wall, particularly prior to laryngeal drop in infants and toddlers
- Timing of aspiration is an important consideration for intervention
- Often lack of cough response in infants

“Assessment & treatment should move beyond observations of potential aspiration events and their causes and place these findings within the context of the patient’s total medical condition.”
~ JR Ashford, 2005
COMMON ABNORMAL VFSS FINDINGS & MODIFICATIONS

Online Modifications
- Delivery Method Change
- Temperature Change
- Positional Change
- Increased Liquid Viscosity
- Textural Modifications
- Limiting Volumes of Oral Feeding

Modifications: Delivery Method
- Symptoms Witnessed:
  - Oral Phase difficulties
  - Inefficiency of oral phase
  - Suck-Swallow-Breathe issues
  - Piecemeal deglutition
  - Swallow reflex delay
  - Aspiration before or during the swallow
- Rationale:
  - Modify the flow
  - Increased bolus control
Modifications: Delivery Method

- Binky Trainer
  - Syringe size
  - Resistance
  - External pacing
- Bottle
  - Non-restricted (any)
  - Specific bottle system
  - Specific nipple flow rate
  - ½ vs full nipple
  - External pacing
- Cup
  - Spouted
  - Restricted or unrestricted flow
  - Holes
  - Open
  - Single vs consecutive sips
- Straw
  - Regular
  - Small diameter
  - Length
  - Capped
- Spoon
  - Size of spoon
  - Amount on spoon

Modifications: Temperature

- Symptoms Witnessed:
  - Swallow reflex delay
  - Aspiration before the swallow
  - Hypo-arousal
  - Fatigue-related dysphagia (non-cardiac)
- Not indicated:
  - Hypersensitive Child
- Rationale:
  - Increased sensory stimulation
  - How: Chill the liquids

Modifications: Positioning

- Symptoms Witnessed:
  - Postural instability
  - Oral phase difficulties
  - Limited laryngeal elevation
  - Airway maintenance issues
  - Asymmetrical dysfunction
  - GERD
  - Gastric emptying issues
- Rationale:
  - Provide increased stability
  - Neutral head/neck alignment
  - Modify the flow
Modifications: Positioning

- How:
  - Upright versus semi-reclined
  - Side-lying
  - Head/neck position
    - Chin tuck
    - Tilt
    - Turn
  - Overall alignment
- Infants and toddlers are unable to participate in independent therapeutic maneuvers so feeder-dependent positioning

Modifications: Thickening

- Symptoms Witnessed:
  - Oral phase difficulties
  - Swallow initiation delay
  - Laryngeal penetration or aspiration before or during the swallow
- Rationale1:
  - Slow the flow
  - Increased bolus control
  - Improve timing of swallow
  - Improve airway closure
- Not Indicated:
  - Residue after the swallow
  - GI intolerance
  - History of or at risk for medical NEC2

```latex
\textsuperscript{1}Cichero et al., 2013
\textsuperscript{2}Goso, 2015
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Modifications: Thickening

- Viscosities:
  - \(\frac{1}{2}\) strength Nectar
  - Nectar Thick Liquid
  - Honey Thick Liquid
- Options:
  - Xanthan Gum Gel
  - Modified Maize Starch
  - Carob Bean Gum (GelMix)
  - Natural Thickening Options
- Since the goal is typically increased control and slowed flow, consider the delivery method carefully!
Thickening: Xanthan Gum Gel
- Brands:
  - Simply Thick
  - ThickenUP Clear
  - AquaClearH20
  - Bob's RedMill Xanthan gum powder
- Pros:
  - Smooth flow; ease; doesn't continue to thicken; thickens breast milk; ketogenic diet; available in packets, pump or pre-made
- Cons:
  - FDA restrictions for preterm infants and children with h/o NEC, warning <12 months of age; supply (internet/home health); cost

Thickening: Modified Maize Starch
- Brands: ThickIt, ThickenUp
- Recipes (SCH):
  - ½ strength Nectar: 1 teaspoon Thick It per 2 oz
  - Nectar: 1 teaspoon Thick It per 1 oz
  - Honey: 5 teaspoons Thick it per 4 oz
- Pros:
  - Readily available; cost
- Cons:
  - Wait; continues to thicken; won’t work with breast milk; variety of products (TI “Original” vs TI-II vs TI-food service); No Thicken Up for < 3 years of age

Thickening: Carob Bean Gum
- Brand: Gelmix
- Pros:
  - Works with breast milk; smooth flow; no FDA restriction/comment (?)
- Cons:
  - Requires heating fluid before thickening; wait; increased thickness with time; cost; recipe specifics; new to USA
### Thickening: Natural Thickening Options

- **How:**
  - Cereal (Rice, Oatmeal)
  - Pureed fruits & vegetables
  - Yogurts
  - Puddings
  - Silken Tofu
  - What else?
- **Pros:**
  - Accessible, “real foods”, caloric value
- **Cons:**
  - Caloric value, inconsistency of mixture, varied texture, irregular flow, arsenic concerns with rice cereal

### Thickening: Flow Principles

- Since the goal is typically increased control and slowed flow, consider the delivery method carefully!
- Flow rate challenges may dictate thickener product selected.

### Flow Rate Variables with Thickened Liquids

**Bottle/Nipple selection makes a Difference:**
- Slit Nipple vs Holed Nipple

**Smooth Nectar + holes vs “chunky” Nectar + slit?**

Do not cut the nipple.
### Thickening: Calories

<table>
<thead>
<tr>
<th>Thickening Agent</th>
<th>Recipe</th>
<th>Total Volume (oz)</th>
<th>Calories</th>
<th>Required Intake Oz/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xanthan Gum</td>
<td>4 oz liquid + 1.5mL thickener</td>
<td>4.5</td>
<td>17.8</td>
<td>22.5</td>
</tr>
<tr>
<td>Starch Thickener</td>
<td>4 oz formula + 1T and 1T to 1.5T thickener</td>
<td>4.7 to 4.8</td>
<td>21</td>
<td>~19</td>
</tr>
<tr>
<td>Infant rice cereal</td>
<td>1 oz liquid + 3 teaspoons thickener</td>
<td>1.1 oz</td>
<td>32</td>
<td>12.5*</td>
</tr>
</tbody>
</table>

*Case Example: Small infant who needs 400 calories/day would require 20 oz/day of human milk or formula, mixed to 20 calories/oz.

~ McCallum, 2011

### Thickening: Costs

- Private insurance rarely covers thickening product
- New Washington State Medicaid law, effective 1/1/2015, states coverage will only be provided for those:
  - 1 year of age
  - Documented need to improve swallow safety by SLP or OT with dysphagia specialization.
  - In addition to above requirements, if < 1 year of age, prior authorization with clinical documentation of medical necessity is required

<table>
<thead>
<tr>
<th>Thickening Agent</th>
<th>Cost Per 4oz Portion</th>
<th>32oz daily goal Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepackaged Gel Thickener</td>
<td>32 to 45 cents</td>
<td>$2.56 to 3.60/day</td>
</tr>
<tr>
<td>8oz Can Starch Thickener</td>
<td>19 to 25 cents</td>
<td>$1.32 to $2.00/day**</td>
</tr>
<tr>
<td>Infant rice cereal</td>
<td>4 cents (2 tablespoons)</td>
<td>$0.32/day</td>
</tr>
<tr>
<td>Prethickened juices</td>
<td>81 cents</td>
<td>$6.48/day</td>
</tr>
<tr>
<td>Prethickened water</td>
<td>76 cents</td>
<td>$6.08/day</td>
</tr>
</tbody>
</table>

~ Chart adapted from McCallum, 2011
Textural Modifications

- Symptoms Witnessed:
  - Oral Phase Difficulties
  - Piecemeal Deglutition
  - Swallow Reflex Delay
  - Nasal Reflux
  - Aspiration before, during or after the swallow
  - Residue after the swallow
- Rationale: Improved bolus control
- How:
  - Liquid “texture” option: carbonation
  - Solid texture hierarchy

1Morishita, Mori, Yamagami, & Mizutani, 2014

Increased Textural Hierarchy

- Infant cereal
- Baby food/stages (Puree)
- Dissolvable solids
- Mashed table foods (Dysphagia Ground)
- Soft cubes
- Chopped/minced
- Soft chewable foods (Dysphagia Mechanical)
- Harder to chew solids (Dysphagia Advanced)
- Regular textures (General/Regular Diet)
- Mixed solids
- Mixed liquid+solids

Modification: Volume

- Modification of value identified and need to sample over time
- Rationale: Assess presence of decline in feeding safety across typical volume for infant/child (endurance can frequently impact safety)
- How: Intermittent fluoroscopy to assess consistency of swallow
  - Feedings on/off paired with fluoroscopy
  - Fluoroscopy on/off guided by SLP
  - Fatigue with barium and/or typical foods or liquid dependent on ideal volume to obtain, goals of fatigue sampling, child’s tolerance
  - Know starting volumes of different conditions present so can keep track of volume offered during the study
Combine VFSS Results with Clinical Swallow Exam (CSE) Findings

- Compare findings to daily function & needs
- Relate findings to child’s underlying health status:
  - Cardiopulmonary status
  - Neurodevelopmental levels
  - GI tract

~Joan Arvedson, 2005 Healthcare Pediatric Dysphagia Seminar

Decision Process/Impact Analysis Regarding Diet Changes

- VFSS is only one source of information
- VFSS outcome is simply a recommendation based on the information that you have witnessed…NOT a decree!
- Team decision/discussion is often warranted before diet levels can be determined
  - Pulmonary status
  - Nutritional status
  - Medical status
  - Socioeconomic status
  - Power of Feeding Team or Aerodigestive Clinic

Faherty & Elliott, WSLHA Short-Course 2015
The Balancing Act of Dysphagia Management

Safety

Quality of Life

Reality

Impact Analysis of Oral Feeding: “To Feed or Not to Feed?”

What is the possible impact of inappropriate oral feeding for a child?
- Chronic Lung Disease & increased respiratory complication
- Child stress
- Parental stress
- Negative impact on parent-child relationship
- Getting caught in a malnutrition spiral

Impact Analysis of Oral Feeding: “To Feed or Not to Feed?”

What is the possible benefit of even limited oral feeding?
- Skill development
- Prevent additional loss of function: “Critical sensitive periods”
- Improved social acceptance & inclusion
- Enjoyment/Qaulity of Life
- Hope!
Impact Analysis of Oral Feeding:
“To Feed or Not to Feed?”

- What is the possible impact of non-oral feeding for a child with dysphagia:
  - Tube feeding
  - Maintenance of ostomy site, tubes, pumps...
  - Fiscal cost of medical supplies, formula...
  - Additional loss of oral feeding skills
  - Inconvenience
  - Sense of abnormalcy in simple daily routine of mealtime
  - Specific oral hygiene plan

Impact Analysis of Oral Feeding:
“To Feed or Not to Feed?”

- What is the possible benefit of non-oral feeding for a child with dysphagia:
  - Improved respiratory function
  - Improved growth
  - Freedom from fear of malnutrition
  - Decreased time devoted to feeding
  - Increased quality of life

Five Year Old for VFSS:
“To Feed or Not to Feed?”

- VFSS Findings:
  - Oral phase indicates developmentally delayed chewing skills
  - Aspiration during the swallow on all liquids
  - Micro-aspiration inconsistently during puree
  - Inconsistent, weak cough after aspiration event

- Medical Diagnosis:
  - Cerebral Palsy
  - History of pneumonia

- Medical Diagnosis:
  - Cerebral Palsy
  - NO history of pneumonia
  - FTT

- Medical Diagnosis: Terminal Cancer
DYSPHAGIA MANAGEMENT
POST VFSS

PO vs NPO?

Dysphagia?

Advanced Dysphagia
Mechanical,
Level 1
Puree Modifications?

Dysphagia?

Regular Thin Liquids
Supervision?

Control
Bite Size
1 Texture
Per bite
1 item of next diet level

SOLIDS
Delivery Method?
Open Cup
Specific Bottle
Any Bottle
Spouted Cup
Restricted valve
Unrestricted valve
Small diameter Nipple
Selection
Regular Straw
Cut Out (Nosey)

Honey Thick Liquids
½ strength Nectar Liquids

½ strength
Nectar Thick Liquids
NPO
Restricted volume
No modifications
Impact of Temperature?

Unrestricted volume
Impact of Fatigue?

Decision Factors & Goal Setting
- Delivery Method?
- Positioning?
- Impact of Temperature?
- Diet Level for Liquids?
- Diet Level for Solids?
- Rate of feeding and size of solids?
- Impact of Fatigue across feeding?
- Supervision?
- Assistance?
Decision Factors & Goal Setting

- Where do we start?
- Which variable(s) can be improved?
- Consider:
  - Safety – swallow safety and lung health
  - Nutritional stability – growth, hydration
  - Development expectations
  - Parent priorities
  - Medical status – upcoming surgeries, seasonal variation
  - Quality of Life
- Realistic sequence of skill development

“Successful oral feeding must be measured in quality of meal time experiences with best possible sensorimotor skills and safe swallowing while not jeopardizing a child’s functional health status or parent-child relationship”

~ Joan Arvedson, 2008

Bottle Feeding / Breast Feeding Issues

- Sucking/Suckling Pattern
- Fluid Flow Mismatch
- Anterior loss
- Bolus Control during Movement
- Oral Transit Time
- Oral Clearance
- Disengagement cues
- Timing of the Swallow Reflex
- Respiratory coordination with the swallow
- Pharyngeal clearance of the bolus
- Consistency of performance across the feeding
Treatment Strategies for Breast / Bottle Feeding Issues

- Positioning
  - Side lying
  - Stabilize: torso support, swaddle
- Flow rate
  - Change bottle
  - Change nipple
- External pacing
- Environmental Supports

Bottle Flow Rate Dynamics

“No single factor determines the flow rate. Equipment factors include:
• hole size;
• pliability of the nipple;
• shape of the nipple;
• position of the fluid relative to the nipple hole, and
• air exchange within the bottle.”

“By eliminating this (hydrostatic) pressure, infants have more control over the flow rate, as fluid does not come from the nipple unless the infant is actively sucking”

~ Ross & Fuhrman, 2015

Bottle to Cup Transition

- Pre-requisites to cup drinking:
  - Stable sitting balance
  - Stable jaw
  - Tongue-jaw dissociation
  - Safe swallow
- Positional supports to maximize success
- Increase viscosity to increase ease when learning
- More fluid in cup = easier
Issues with Cup Drinking

- **Gulper:**
  - Increase neck elongation
  - Increase viscosity to slow the flow
- **Resting cup on tongue:**
  - Scoop tongue into cup
- **Biting on cup:**
  - Move the cup out and rest on lips
- **No central groove:**
  - Work on tongue when not cup drinking
  - Channel the cup
  - Thicker liquids
  - Straw

What **Should** a Child Eat?

- **Resources:**
  - Registered Dietitian
  - Pediatrician
  - Child of Mine by Ellyn Satter
  - Feeding & Nutrition for the Child with Special Needs by Marsha Dunn Klein & Tracy Deloney

Increased Textural Hierarchy

- Infant cereal
- Baby food/stages (Puree)
- Dissolvable solids
- Mashed table foods (Dysphagia Ground)
- Soft cubes
- Chopped/minced
- Soft chewable foods (Dysphagia Mechanical)
- Harder to chew solids (Dysphagia Advanced)
- Regular textures (General/Regular Diet)
- Mixed solids
- Mixed liquid + solids
Not All Textures are Created Equal!

Quality of Chewing

- Textural Complexity Hierarchy
- Good Postural Control
- Type of Chew
  - Anterior chew
  - Vertical Munch
  - Early Rotary
  - Mature Rotary
- Textural Variance to find Optimum Performance
  - Increased hardness elicits differences in chewing
    ~Steele et al., 2013

Issues with Chewing

- Lip closure
  - Posture
  - Facilitate jaw closure not lip
- Cervical hyperextension
  - Position feeder to child
  - Positional support
- Lack of tongue lateralization
  - Food placement to side
  - Stimulation to lateral borders of tongue
- Exaggerated jaw movement
  - Oral control to increase gradation
  - High tone in cheek
  - Scissoring
  - Food Selection matched with skill level

The ability to tolerate unmodified foods depends on the infant’s oral experiences and the ability of the lips, tongue and jaw to work as independent and co-dependent units.

~Cichero et al., 2013
Expanding Food Repertoire

- Careful selection of new food item:
  - Change only one variable from a familiar/accepted food if possible…
  - Select item that is likely to be a textural success for the child (baseline chewing ability)
  - Control complexity of environment
  - Repeated exposure in a non-threatening manner…
  - Make mealtime PREDICTABLE
  - YOU eat the new food too!
  - Patience, Patience, Patience

Faherty & Westendorf, 2008

Diet Expansion Strategies

- Sensory/Oral Prep
- Steps to eating
  - (Kay Toomey)
- Food Chaining
  - (Cheri Froker & Laura Wolbert)
- Food properties
- “Sell the Food”
- Predictability
  - Respect…no tricks!

A Personal Story I call “Jeff Perseveres”

I do NOT like EGGS!!!
I do NOT like EGGS, (except quiche).

I do NOT like EGGS, (except quiche & frittata)!

I do NOT like EGGS, (except quiche, frittata, & omelets).
I do NOT like EGGS, (except quiche, frittata, omelets & Jeff’s scrambled eggs)

I actually DO LIKE eggs, (as long as they’re not sunny-side up!).

18 Years of Marriage Later…

Age Appropriate Feeding Routines
- Developmental Expectations
  - Volume per meal
  - Volume per day
  - Textural complexity
- Establish mealtime routine appropriate to age
- Sitting to eat
- Meals with siblings
- Assist with meal prep to prepare sensory
- Age appropriate utensil selection
- Pacing of meals
- Parental role versus Child’s role at the meal
- Communication cues throughout a meal
Management of Dysphagia Patients

- Diet advancement to age level function as secondary goal:
  - Oral versus tube feedings: balancing act
    - Not all or none decision...
  - Gradual, systematic transitions with diet advancements...
  - Optimum SAFE oral intake to meet needs
  - Quality of oral feedings
  - Developmental expectations

Dysphagia Management: Diet Advancement Process

- Stable baseline health of child at current diet level?
  - Medical concurrence
- Select one variable at a time to progress:
  - Volume/feeding
  - Number of oral feedings per day
  - Diet level
    - Liquid viscosity
    - Solid textural complexity
    - May need to subdivide diet levels depending on baseline health
- Progress in consistent time based intervals
  - At least 5-7 days between each variable’s introduction per pulmonology recommendations
    - SCH Pulmonary Team recommendations
  - Baseline # of days per variable may need to be extended dependent on medical complexity of child
Dysphagia Management: Diet Advancement Process

- Monitor for “5 signs” of difficulty:
  - Increased coughing/choking or overt signs of difficulty during a feeding
  - Increased congestion or URI symptoms
  - Spiked fever
  - Increased reflux symptoms (liquids) or increased constipation/GI intolerance symptoms (solids).
  - Increased refusal by child
- Revert back to child’s last successful diet advancement level to stabilize if any of the above issues arise

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Dysphagia Management: Diet Advancement Process Scenario

- Child currently on HTL diet restriction given previous VFSS with silent aspiration of thins & NTL.
  - Total of 50% of intake per day is consumed orally at time of repeat VFSS.
- History of frequent URI/Pneumonia in past, but currently stable with no known respiratory difficulties for last 2 months.
- Repeat VFSS:
  - Delay in swallow reflex initiation
  - No laryngeal penetration or aspiration of NTL or thins, but limited sample.

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Dysphagia Management: Diet Advancement Process Scenario

- Gradual cautious transition plan: Knowing that child is stable on current diet, begin transition plan at next diet level, rather than going all the way to thin liquids.
  - Week one: Nectar thick liquids.
    - Monitor for tolerance for next 5 – 7 days, watching for your “5 signs” of difficulty.
    - If things go awry, back to HTL.
  - Week two: If all is well, continue NTL, but increase amount of liquid consumed per day orally.
    - If things go awry, back to NTL with restricted volumes/day
  - Week three: If all is well, then advance to thin liquids.
    - If things go awry, go back to NTL rather than HTL...
Transitioning off Tube Feeding

- Gradual Wean
  - Child driven
- Controlled Wean
  - Team driven over time
- Rapid Wean
  - Team driven quickly
  - Intensive, inpatient program

Case Study Illustrating a Team Approach to Dysphagia Management

- Kate upon referral to Feeding Therapy at 3 months of age for feeding therapy
  - Severe Cardiac Condition s/p prolonged NICU course and multiple surgeries
  - Severe Dysphagia & GERD w/ G-J tube dependency

Kate's Treatment Course

- SLP feeding treatment goals at 5 months of age
  - Desensitization/Sensory Normalization
  - Oral motor skill development
  - Stimulation at lips without vomiting
    - No appreciable oral intake
- RD assessment:
  - G-tube tolerance w/o vomiting
    - 21 ml/hr continuous drip
  - Growth
Kate’s Treatment Course

- **SLP goals at 10 months of age:**
  - Tolerating > 30 mL liquid by bottle
  - Introduction of cup drinking
  - Tolerating > 2 ounces of puree foods x 3/day
  - Increase variety of puree foods accepted

- **RD goals:**
  - G-tube rate: 105 mL bolus feeds x 3 840 mL/day
  - Change formula type
  - Increase % of kcals delivered orally

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Kate’s Treatment Course

- **Medical management:**
  - Additional heart surgeries at 12 months of age

- **VFSS post-operatively:**
  - Swallow delay
  - Laryngeal penetration and aspiration on thin liquids
  - Safe with:
    - Puree foods
    - NTL via the bottle
    - HTL via the cup
  - Fatigue-related dysphagia symptoms with liquids

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Kate’s Treatment Course

- **SLP goals at 18 months:**
  - Honey thick liquids by cup
  - Nectar thick liquids by bottle
  - Soft to chew solids

- **RD goals:**
  - 1 bolus per tube/day
  - Pediasure orally to augment caloric intake
  - Growth velocity to continue

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Kate’s Treatment Course

- Repeat VFSS: Cleared for NTL on all drinking modes
  - Aspiration with thin liquids via open cup
  - Protective cough reflex noted consistently

- Therapy worked on cup drinking skill development
  - Gradual decrease in viscosity on restricted flow valve cup and small diameter straw
  - Gradual transition to open cup drinking, first with NTL then 1/2-strength NTL and finally thin liquids

Kate’s Treatment Course

- SLP & RD status by 3 years of age:
  - 100% nutritional needs met orally
  - G-tube removed
  - Age appropriate textural complexity
  - Safe with thin liquids
  - All drinking modes
  - Appropriate growth velocity at Discharge!

FURTHER ASSESSMENT
Oral Feeding Influences

Feeder
Maturity
Oral-Motor Control
Neurological Function
State Regulation
Muscle Tone
GI Tolerance
Respiratory Status
Sensory Integration

Further Assessment Options

- Esophageal Phase concerns:
  - GI, Radiology
- Structural concerns:
  - ENT, GI, Neurology
- Respiratory concerns:
  - Pulmonary
- Aerodigestive Clinic / Feeding Team
- Neurodevelopmental concerns:
  - Neurology, Neurodevelopmental Pediatrician
- Nutrition concerns: Dietician
- Environmental concerns:
  - MSW, Psych, MD, CPS, allergist

Principles to Consider:
Repeat VFSS Procedure(s)

- Information needed for this child:
  - Further definition of problem/diagnosis
  - Guide management decisions
  - Change in medical situation
  - Change in swallowing/feeding over-time
  - Modification of current feeding routine is an anticipated outcome from repeated VFSS
  - Parent education/compliance
- Should NOT be based on arbitrary time intervals!
Therapeutic Modifications Assessed Over-Time with VFSS

- **Medical Status Changes:**
  - Progression of neurologically degenerative disease
  - Improvement in overall medical status to allow for diet advancement following previous VFSS requiring oral diet restrictions

- **Medication Changes:**
  - Quality of swallowing function assessed following:
    - New medication introduced
    - Dosage changes

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Therapeutic Modifications Assessed Over-Time with VFSS

- **Developmental Changes:**
  - Maturation = Physiological and/or Anatomic changes
  - Quantify progress & allow for diet advancement

- **Oral-Motor Treatment:**
  - Objective analysis to document progress
  - Verify positive impact of therapy
  - Advance Diet!

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Persistent Dysphagia on VFSS

- **What are your next steps?**
  - Consultation with colleagues ("new eyes")
  - Re-evaluate goals and expectations
  - Further work-up
    - Discipline specific
    - Multidisciplinary clinics
    - Aerodigestive Clinic / Feeding Teams
  - Keep digging – Why? What are the barriers?
Scenario #1

- **Patient:**
  - Typically developing 3 year old
  - Persistent deep laryngeal penetration and aspiration with no change on three VFSS exams
- **Problem/Barriers?**
- **Where do you go from here?**

Scenario #2

- **Patient:**
  - Typically developing 3 year old
  - Cleared for thin liquids on last VFSS
  - Failed transition to thin liquids
- **Problem/Barriers?**
- **Where do you go from here?**

Scenario #3

- **Patient:**
  - Developmentally delayed 3 year old
  - Dysphagia solid diet dictated by oral-motor delay
  - Dysphagia liquid diet dictated by silent aspiration
  - Non-compliant environment
- **Problems/Barriers?**
- **Where do you go from here?**
Scenario #4

- **Patient:**
  - Medically complicated 3 year old: post cardiac surgery with unilateral vocal fold paralysis
  - Fatigue-related dysphagia with aspiration on thin liquids
- **Problem/Barriers?**
- **Where do you go from here?**

**SUMMARY**

- For Successful Feeding
  - Team approach including family
  - Importance of solid clinical exam including history
  - Importance of defined questions going into VFSS procedure
  - Combining findings of CSE, VFSS, medical status, etc to define safe feeding plan
  - VFSS is only one component of management of dysphagia
  - It Takes a Village
The Balancing Act of Dysphagia Management

Safety
Quality of Life
Reality

Successful Feeding
No Matter How You Define It