

TITLE

ORAL FEEDING

SCOPE

Neonatal Intensive Care, Calgary Zone

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NOTE: Terms in bold in the body of this document (except titles) are defined terms – please refer to the Glossary of Terms.

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Nutritive Sucking Stages
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Stage III: Full oral intake (> 80% of daily volume)
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OBJECTIVES

- To provide evidence-based guidelines for families and healthcare providers for the introduction and management of oral feeding for high-risk infants
- To promote a consistent feeding approach
- To foster positive, safe, and individualized developmentally appropriate feeding experiences for infants
- To minimize the risk of developing aversive feeding behaviours
- Clinical judgment may be exercised when a situation is determined to be outside the parameters provided in this guideline. If a deviation from this guideline is determined to be appropriate or necessary, documentation of the rationale shall be included on the patient's health record.

APPLICABILITY

Compliance with this document is required by all Alberta Health Services employees, members of the medical and midwifery staffs, students, volunteers, and other persons acting on behalf of Alberta Health Services (including contracted service providers as necessary) working in the Calgary Zone, Neonatal Intensive Care Units and Women's Health.

ASSUMPTIONS AND RATIONALE

1. Currently there is no consensus on the minimum gestational age for safe introduction of oral feeding (1). Therefore, this guideline encompasses all infants from pre-oral to full oral feeding based on infant characteristics and not gestational age.
2. As primary caregivers, parental feeding goals are integral to the feeding plan (2) (3).
3. Breastfeeding is a safe method (4) and the preferred method of oral feeding. Infants who are breastfed exhibit better oxygen levels, coordination of SSB, temperature control and heart rate stability than infants who are bottle fed (5) (6) (7) (8) (9).
4. When breastfeeding is the goal, the breast should be the first nipple experience and when mother is present, breast should always be offered (2) (10).

5. A **co-regulated cue-based** approach to feeding is dependent on the ability of the caregiver to read the infant's cues and respond with individualized strategies for a successful feeding experience (11) (12) (13) (14) (15). Cue-based feeding is infant driven and promotes safe and efficient feeding and may shorten length of stay (9) (16) (17) (18) (19) (20).
6. Support of the development of positive feeding skills for infants and parents begins at admission to the NICU and is continuous until discharge and beyond. Successful feeding is contingent upon engagement and commitment of all members of the health care team (12) (20).
7. Every feeding experience matters. Positive and negative experiences shape the developing brain (12) (13) (18) (21) (22) .
8. Feeding is an active social interaction between caregiver and infant.
9. Development of oral feeding follows stages that can be identified (23) (24).
10. Stages are used to plan physiologically appropriate feeding experiences (24) (25).
11. Movement within and between stages may be bi-directional.
12. Neurological immaturity and/or illness impact an infant's progress through stages (26) (27) (28) (29) (29) (30) (31). For example a healthy preterm infant may be able to achieve oral feedings by 36 weeks, whereas a preterm infant with co-morbidities may take well beyond 40 weeks. Small-for-gestational age preterm infants may not reach normal sucking patterns until well beyond term (48-50 weeks post conceptual age) (32).
13. Experience plays a significant role in the maturation of nutritional sucking patterns (9) (33) (34) (35). Smaller volumes and more frequent feeding practice accelerate feeding skill maturation and may contribute to shorter hospitalization (36) (37) (38).
14. Not all infants will achieve Stage III feeding prior to discharge. Most infants are sufficient but not necessarily efficient feeders at the time of discharge (39). Feeding skill maturation and endurance continue to evolve post discharge (35). Infants that learn to feed with an individualized, developmentally-supportive, evidenced-based approach have significantly fewer feeding problems post-discharge (e.g., less arching, less vomiting, and fewer infants requiring feeding consultation) (19). Addressing feeding problems promptly will help to avoid feeding struggles, oral aversion, growth faltering, and jeopardizing the parent-infant relationship (18) (29) (39) (40). Some infants will require post discharge enteral feeding and outpatient support (41).
15. Feeding infants is a skilled task, and competency must be assured (3) (12) (14) (18) (20). Education of healthcare providers is vital to understand evidence-based feeding strategies (8) (10) (18) (42).

PRINCIPLES OF FEEDING

- 1 **ASSESSMENT: Continuously assess the infant's state and responses before, during and after non-nutritive sucking (NNS) and nutritive sucking (NS) experiences. (14) (18) (23) (43) (44) (45). Assessment includes:**
 - 1.1 **Infant characteristics to determine the appropriate oral feeding stage:**
 - a) The optimal time to commence oral feeds or where to position the infant on the oral feeding guideline is based on an individualized assessment of an individual infant's readiness and skill to orally feed (breast or bottle), rather than basing the decision solely on gestational age (38) (45) (46) (47).
 - b) Feeding success is promoted when caregivers make feeding decisions and actions based on the infant's characteristics (9) (13) (16) (18) (34) (48).
 - 1.2 **Position and latch:**
 - a) **NNS** skill, rooting reflex
 - 1.3 **Engagement/readiness cues: (37) (49)**
 - a) Manages secretions (50) (51)
 - b) Stable physiologic responses, stable with handling
 - c) Identifiable hunger cues, e.g., restless before feeds, lip smacking, hand to mouth, rooting, crying (late sign)
 - d) Maintains a quiet/alert state (23) (52) (53)
 - e) Emerging or sustained and coordinated suck/swallow/ breathing (SSB)
 - f) Resting Respiratory Rate (RR) less than or equal to 60 bpm for infants born at less than 36 weeks (54) (55) - these infants may not be able to compensate for the required interruption of breathing during swallowing and silent **aspiration** may result (54)
 - g) Resting RR less than or equal to 70 bpm for infants born at greater than or equal to 36 weeks providing there are no other signs of distress (49) (56)

1.4 **Disengagement/distress cues:**

- a) Difficulty initiating feeding
- b) Significant changes in heart rate:
 - (i) Bradycardia - dramatically decreased from baseline and/or associated with desaturations may indicate aspiration, incoordination of SSB (57)
 - (ii) Tachycardia - dramatically increased from baseline heart rate and remains elevated may indicate work of feeding is excessive
- c) O₂ saturation outside lower normal limits
- d) Color changes from baseline (pallor, cyanosis, mottled)
- e) Significant changes in respiratory effort (rate, grunting, nasal flaring, retractions, apnea) (49) (55) (58) (59) (60). Sustained tachypnea may put the infant at risk for aspiration
- f) Loss of postural tone
- g) Loss of state
- h) SSB becomes disorganized (pooling or loss of bolus, hard swallowing, coughing, gagging)
- i) Loss of latch or poor latch (wide jaw excursion, shallow latch, chomping, clamping, biting)
- j) Refusal
- k) Motor stress cues (finger splaying, raised eyebrows, arching, squirming, eye blinking)
- l) Shutting down or fatigue

NOTE:

*Disengagement/ distress cues may be a sign of **GERD**. GERD may contribute to poor intake, poor weight gain, feeding refusal, and lack of progression (61). Refer to GERD Clinical Practice Guidelines and Gastroesophageal Reflux Parent Handout (#608103)*

2 FEEDING PLAN: (62)

- 2.1 The feeding plan must be individualized, reflect parent goals, be communicated among healthcare providers, and be documented for each infant.
- 2.2 Feeding plan should be reviewed with the parents and the healthcare team daily.
- 2.3 Feeding interventions are contingent on infant responses (10) (63) (64).
- 2.4 Documentation should summarize infant engagement/disengagement cues, and strategies used to support feeding skills (16).

3 FEEDING PLAN TRANSITION:

- 3.1 Movement within and between stages may be bi-directional.
- 3.2 Refer to individual stage for guidelines to advance/regress stages.
- 3.3 Avoid rapid stage advancement to allow the infant to practice and then consolidate feeding skills.
- 3.4 Consider not progressing feeding stage on or just prior to days on which the infant experiences potential challenges such as eye exam, immunizations, transfers, or change in frequency or volume of feeds, or change in respiratory support.

STAGES OF NEONATAL FEEDING

Pre-Oral Stage			
INFANT CHARACTERISTICS	GOALS	INTERVENTIONS	WHEN TO REFER
<p>Responds adversely to handling</p> <p>Poor physiologic, motor & state regulation with or without stimulation</p> <p>None to very weak oral reflexes (transient)</p> <p>None to very weak non-nutritive skills</p> <p>Not managing secretions (e.g. infants with neurological compromise)</p> <p><u>By the end of this stage the infant demonstrates the following characteristics and may be ready to move to the next stage:</u></p> <ul style="list-style-type: none"> • Consistent physiologic stability with handling • Emerging licking and sucking cues 	<p>Facilitate parent feeding goals</p> <p>Establish and maintain mother's milk supply</p> <p>Positive co-regulation relationship</p> <p>Minimize negative oral stimulation</p> <p>Promote behavioural organization</p> <p>0 % oral intake (excludes OIT)</p>	<p>Discuss and document parent feeding goals</p> <p>Discuss with parents realistic expectations for initiation and progression of feeding</p> <p>Support the mother in initiating and maintaining lactation (62)</p> <p>Use age appropriate care interventions to facilitate midline position and flexion which promotes hand to mouth experience and behavioural organization (3) (65)</p> <p>Positive experiences to the facial area as tolerated by infant (65) (66)</p> <ul style="list-style-type: none"> • Skin to Skin • Sustained touch <p>Olfactory stimulation with EBM near nose should be offered (3) (67) (68)</p> <p>Tube feeding only</p> <p>See: Skin-to-Skin Care 2-S-6 See: Cue-Based Care 2-C-9 See: Oral Immune Therapy 2-O-7 See: Gastric Tubes 2-G-1</p>	<p>Refer to LC if mother:</p> <ul style="list-style-type: none"> • Has difficulty establishing/maintaining lactation • Experiences complications as a result of pumping • Has difficulty in accessing breast pump <p>After first considering gestational age and severity of illness, refer to OT when:</p> <ul style="list-style-type: none"> • Physiologically stable to progress to next stage, but shows no emerging sucking skills • Hypersensitive to oral touching • Not managing secretions, absent gag, or compromised suck/swallow

Non-Nutritive Sucking Stage			
INFANT CHARACTERISTICS	GOALS	INTERVENTIONS	WHEN TO REFER
<p>Stable with handling and able to maintain physiologic, motor and state stability with NNS practice</p> <p>Oral reflexes emerging</p> <p>Demonstrates licking and rooting</p> <p>Learning to latch</p> <p><u>By the end of this stage the infant demonstrates the following characteristics and may be ready to move to the next stage:</u></p> <ul style="list-style-type: none"> Effective NNS by: <ul style="list-style-type: none"> Establishing and maintaining effective latch Rhythmical sucking bursts Coordinating sucking and breathing Stable with pairing of NNS and tube feeding 	<p>Facilitate parent feeding goals</p> <p>Support mother's milk supply</p> <p>Positive co-regulation relationship</p> <p>Promote positive oral experiences at breast/soother</p> <p>0 % oral intake (excludes OIT)</p>	<p>Discuss and document parent feeding goals</p> <p>Discuss with parents realistic expectations for initiation and progression of feeding</p> <p>Support the mother in initiating and maintaining lactation</p> <p>Help parents access breastfeeding/ oral feeding educational resources (handouts and videos)</p> <p>Provide positive facial experiences and NNS:</p> <ul style="list-style-type: none"> Skin-to-skin care (65) (69) Allow infant to nuzzle and practice at an appropriately pumped breast Position to support hand to mouth contact to allow the infant to suck (70) Standard shaped soother only (51) (70) (71) (no orthodontic, flat or bulb shaped pacifiers) Never force a nipple into the infant's mouth Pacing as needed <p>Transition to Pairing NNS and Tube Feeding:</p> <ul style="list-style-type: none"> Once infant attains NNS stability, <u>all above methods</u> of NNS can be combined with tube feeding if tolerated (e.g. gavage feeding while nuzzling at breast) 	<p>Refer to LC when:</p> <ul style="list-style-type: none"> There is a concern with mother's breasts or milk supply Infant shows distress at the breast <p>After first considering gestational age and severity of illness, refer to OT when:</p> <ul style="list-style-type: none"> Persistent physiologic instability with NNS Consistently refusing NNS Difficulty transitioning to pairing NNS and tube feeding Abnormal suck Query safety of swallowing <p>Refer to Home Nutrition Support Service, Feeding Therapist (OT/SLP), Neonatal Transition Team (NTT) and/or Pediatric Home Care when:</p> <ul style="list-style-type: none"> Infant is to be discharged home on any amount of tube feeding

<p align="center">Nutritive Sucking Stage I: <u>Minimal Oral Intake</u> (<10% of daily volume) Infants who meet SINC eligibility refer to SINC Algorithm Protocol</p>			
INFANT CHARACTERISTICS	GOALS	INTERVENTIONS	WHEN TO REFER
<p>Emerging readiness cues</p> <p>Managing secretions</p> <p>Good NNS; emergent but no sustained SSB coordination</p> <p>Stable with handling and able to maintain physiologic, motor and state stability with minimal oral intake</p> <p><u>By the end of this stage the infant demonstrates the following characteristics and may be ready to move to the next stage:</u></p> <ul style="list-style-type: none"> Beginning to self pace Breastfeeding: Infant demonstrates evidence of milk transfer with physiologic stability Bottle feeding: Infant is able to take 10% of feeding orally with physiologic stability 	<p>Oral Intake <10% of daily volume</p> <p><u>Oral practice only</u> - focus on quality and ambiance rather than quantity taken</p> <p>Facilitate parent feeding goals</p> <p>Support mother's milk supply</p> <p>Develop SSB coordination with small volumes at breast/bottle</p> <p>Positive co-regulation relationship</p>	<p>Minimize distracting stimuli while feeding (53)</p> <p>5-10 minutes oral feeding practice (breast/bottle)</p> <p>Intervene promptly with signs of distress</p> <p>Explore proactive strategies to prevent distress (optimal positioning, pacing, flow rate)</p> <p>Use pacing and rest breaks as needed</p> <p>Breast or bottle at a feed – not both</p> <p>Utilize parent teaching resources</p> <p>Breastfeeding Practice:</p> <ul style="list-style-type: none"> Position skin to skin and lower infant to good breastfeeding position Practice at appropriately pumped breast If disorganized, try NNS first Hand express or drip milk from syringe onto mother's nipple to assist with latch if needed Pair tube feeding with breastfeeding practice <p>Bottle Feeding Practice:</p> <ul style="list-style-type: none"> Swaddle to promote organized behaviour. Provide postural stability, e.g. side-lying on pillow with head 	<p>Refer to LC when:</p> <ul style="list-style-type: none"> Mother's milk supply is a concern Unable to achieve milk transfer Unable to achieve latch Infant consistently frustrated at breast Complications present (e.g. cracked nipples, mastitis) <p>Refer to OT when:</p> <ul style="list-style-type: none"> Infant at high risk for dysphagia: <ul style="list-style-type: none"> Gurgling sounds in pharynx Coughing during feeding Stridor or noisy breathing during feeding Difficulty managing secretions (Aspiration may be silent) Persistent feeding induced apnea and bradycardia Good NNS but refuses NS Poor, unusual, or unsustained latch i.e., excessive wide jaw excursion Failure to progress from this stage GERD resulting in emerging feeding refusal <p>Refer to Home Nutrition Support Service, Feeding Therapist (OT/SLP), Neonatal Transition Team (NTT) and/or Pediatric Home Care when:</p> <ul style="list-style-type: none"> Infant is to be discharged home on any amount of tube feeding

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		<p>elevated</p> <ul style="list-style-type: none">• Begin all feedings with brief NNS to help organize infant state and skills (72) (73) (74) (75)• Therapeutic tasting: Single drops from 1 ml syringe onto soother. Can progress to milk dripped from syringe into open nipple. If volume > 5ml may consider transitioning to bottle• Use slow flow single-hole nipple (5) (13) (24) (76) (77) (78) (79) (80) (81)• Never jiggle or turn nipple to stimulate NS; <u>this practice is contraindicated</u> (3) (13) (82)	
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Nutritive Sucking Stage II A, B & C: Moderate Oral Intake

(10% to <80% of daily volume)

Infants who meet **SINC** eligibility refer to SINC Algorithm Protocol

INFANT CHARACTERISTICS	GOALS	INTERVENTIONS	WHEN TO REFER
<p>Inconsistent but identifiable readiness cues:</p> <ul style="list-style-type: none"> • Hand to mouth, rooting • Increased motor activity prior to feeding <p>The infant may demonstrate readiness to feed at some feedings throughout the day, but not necessarily all the feedings</p> <p>Improving SSB</p> <p>Improving endurance but not enough to maintain full oral feeding</p> <p>Immature state control – unable to maintain quiet alert state throughout entire feeding</p> <p>Consistent self-pacing may or may not be present</p> <p>A positive breastfeeding experience is defined as an infant who demonstrates a good latch, sustained bursts of nutritive sucking, and audible swallowing for several minutes</p>	<p>Facilitate parent feeding goals</p> <p>Support mother’s milk supply</p> <p>Breastfeeding goal at this stage is increased exposure and experiences at the breast</p> <p>Positive co-regulated relationship</p> <p>To facilitate the transition to full oral feeding by supporting endurance, skills and physiologic stability</p> <p>Quality and ambiance is still more important than quantity taken</p>	<p>Use a gentle approach to invite infant to feed (e.g. gentle touch, soothing voice, closer proximity to breast, soother to lip) (43) (83). If infant does not arouse - do not orally feed</p> <p>Once aroused, NNS may help with state control and SSB coordination (84)</p> <p>Ensure correct placement of NG/OG tube and/or consider replacing with a smaller tube if the infant consistently decompensates during oral or tube feeding (85) (86)</p> <p>Feedings should not be pushed. Infants will become physiologically unstable if pushed (22) Watch for distress/ disengagement cues closely and if present, remainder of feeding should be tube fed (50) (51) (63) (87)</p> <p>Smaller volumes and more frequent feeding practices accelerate feeding skill maturation (33) (36)</p> <p>If still wanting to suck after consuming the top limit of the current stage (II A, B or C) offer NNS at breast/soother with gavage feed. Consider advancing feeding stage when infant shows consistent feeding competency for a minimum of 24 hours</p>	<p>Refer to LC when:</p> <ul style="list-style-type: none"> • Poor latch evident • Infant falls asleep at breast • Poor milk transfer suspected • Considering test weighing • Considering use of nipple shield <p>Refer to OT when:</p> <ul style="list-style-type: none"> • Poor unsustained latch • Flooding present • Good NNS but poor NS • Signs of dysphagia • Persistent feeding induced apnea and bradycardia • Failure to progress from this stage • GERD resulting in emerging feeding refusal <p>Refer to Home Nutrition Support Service, feeding therapist (OT/SLP), and</p>

<p><u>By the end of stage II C the infant demonstrates the following characteristics and may be ready to move to the next stage:</u></p> <ul style="list-style-type: none"> • The infant consistently demonstrates readiness to feed with attainment of self-regulatory strategies at the majority of feedings throughout the day • Sufficient but not necessarily efficient SSB • Endurance to achieve 80% oral feeding • Pacing may or may not be required • The infant demonstrates consistent positive breastfeeding experience for longer periods of time with improved milk transfer 		<p>Breastfeeding:</p> <ul style="list-style-type: none"> • Facilitate breastfeeding as often as possible. Encourage breastfeeding mothers to spend long blocks of time in nursery to facilitate cue-based feeding (8) (88) • Appropriately pumped breast (89) • Teach optimal BF positioning and helping mothers to understand how breastfeeding should look and feel for both mom and baby) • Pacing for breastfed infants as needed. Strategies include: <ul style="list-style-type: none"> • Removing baby from breast during milk ejection reflex • Allowing baby to reorganize before placing back on breast • Test weighing pre and post breastfeeding for measurement of milk intake – this allows for an objective assessment of intake (3) (34) (90). Need for test weighing needs to be individualized. Goal is to teach mom to estimate their own milk transfer • Reassess mom’s milk supply (min 500-600 ml/day) <p>Bottle feeding:</p> <ul style="list-style-type: none"> • Swaddle, side-lying, elevated on pillow • Start with brief NNS • Slow flow nipple (5) (13) (24) (76) (77) (78) (79) (80) (81) • Before feeding unscrew nipple to relieve pressure and retighten • Use pacing and rest breaks as needed • Never jiggle or rotate nipple to make infant suck (3) (13) (82) 	<p>NTT or Pediatric Home Care when:</p> <ul style="list-style-type: none"> • Infant is to be discharged home on any amount of tube feeding
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		<p>Additional Stage II interventions are matched to the percentage oral intake as follows:</p> <p>Stage IIA: 10% to <25% of daily volume</p> <ul style="list-style-type: none">• Maximum 15 minutes at breast or 10 minutes at bottle• Avoid breastfeeding and bottle feeding practice at same feeding <p>Stage IIB: 25% to <50% of daily volume</p> <ul style="list-style-type: none">• Maximum 20 minutes oral feeding time• Avoid breastfeeding and bottle feeding practice at same feeding <p>Stage IIC: 50% to <80% of daily volume</p> <ul style="list-style-type: none">• Maximum 30 minute oral feeding time• Offer a burp break• When a breastfeeding infant becomes more consistent with positive breastfeeding experiences, consider test weighing pre post breastfeeding (91) (92) (93) as the infant may not need supplementation	
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Nutritive Sucking Stage III: Full Oral Feeding (≥80% of daily volume)

INFANT CHARACTERISTICS	GOALS	INTERVENTIONS	WHEN TO REFER
<p>Sufficient SSB throughout the feeding with or without pacing</p> <p>Oral intake ≥ 80% daily volume</p> <p>Feeding cues more consistent:</p> <ul style="list-style-type: none"> • Hand to mouth, rooting • Increased motor activity • Wakes on own for most feeding • Slips off nipple at end of feeding • Falls asleep at end of feeding <p><u>A Stage III infant may be ready for discharge when:</u></p> <ul style="list-style-type: none"> • Feeding by breast or bottle without cardiorespiratory compromise (3) • Demonstrating endurance to maintain nutritional intake to support growth <p>Note: Ideally the infant should demonstrate these characteristics >2 days pre-discharge</p>	<p>Facilitate parent feeding goals</p> <p>Promote efficient feeding skills</p> <p>Oral feeding that supports growth</p> <p>Feeding experience is positive to infant and caregiver</p> <p>Parents achieve competence and confidence in breast and bottle feeding and formula preparation</p> <p>Transition to twice weekly weights</p>	<p>Encourage caregivers to spend extended times in NICU to understand infant feeding cues and participate in semi-demand/ demand feeding</p> <p>Maximum 30 minutes of oral feeding time</p> <p>Optimal positioning</p> <p>Use pacing and rest breaks as needed</p> <p>Offer burp break</p> <p>Consider no gavage top-up if infant consumes >80% of feed for at least 24 hours</p> <p>Transition to semi-demand (no longer than 3 ½ hours) cue-based feeding before discharge; volume and frequency between feedings may vary greatly throughout day (36) (64) (91) (94) (95) (96) (97) (98) (99) (100)</p> <p>Example:</p> <ol style="list-style-type: none"> 1. Remove the OG/NG tube, decrease the current TFI to promote hunger driven feeding versus volume feeding (e.g.: if on 160 ml/kg/day – decrease to minimum 130 ml/kg/d and monitor growth over a 24-48 hour period) 2. If unsuccessful: replace OG/NG tube and allow infant to semi demand for 12 hours with no gavage top-up followed by topping up the volume shortfall divided over the next 12 hours. Consider a repeat trial every 2-3 days <p>Discuss feeding expectations for home. Most infants at this stage are sufficient feeders and may take time to become efficient feeders. If concerned, care givers should follow up with healthcare providers, e.g. PHN, NTT, LC, MD, Feeding</p>	<p>Refer to LC when:</p> <ul style="list-style-type: none"> • Poor latch evident • Poor milk transfer suspected • Poor weight gain • Poor milk supply • Use of a nipple shield <p>Refer to OT when:</p> <ul style="list-style-type: none"> • SSB incoordination • Signs of dysphagia • Immature or atypical sucking pattern • Inefficient feeding (e.g. prolonged feeding time) • Poor endurance • Neurological impairment • Persistent feeding refusal • GERD impacting feeding or sleep

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		<p>Therapist (OT/SLP), dietitian.</p> <p>Breastfeeding:</p> <ul style="list-style-type: none"> • Nipple shield teaching and plan for weaning • Discuss pumping strategies for home • Transition off test weighing to mother's own estimation. • Prior to discharge, if infant requires extra volume or calories, use bottle top ups with a maximum of 30 minutes total feeding time <p>Bottle feeding:</p> <ul style="list-style-type: none"> • The infant should be transitioned to the nipple and feeding regime that parents are planning to use at home. This will enable matching of the infant's skills to the nipple to be used. A commercial single hole, <i>slow flow</i> straight nipple is recommended. (50) (51) (81) (87) <i>Refer to parent handout on commercial soother and bottle nipple selection.</i> • Continue side-lying elevated position if needed 	
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GLOSSARY OF TERMS

Age Appropriate Care: An approach to individualize infant care in order to maximize neurological development and reduce long term cognitive and behavioural problems (101).

Appropriately Pumped Breast: Breast pumping of a small amount of milk may be advised if the breast is too full to facilitate an easy attachment, to decrease the amount of milk flow released during the **MER** (milk ejection reflex) and/or to prevent flooding (47).

Aspiration: The passage of saliva, liquid or food below the level of the vocal cords (102).

- Aspiration can result from a primary swallowing dysfunction or from incoordination between sucking, swallowing, and breathing. Aspiration can be descending (during feeding) or ascending (during gastroesophageal reflux) (51).
- Sometimes aspiration occurs with fatigue towards the middle or end of a feeding and is referred to as fatigue aspiration (51) (103).
- Aspiration can be silent (no coughing, choking, or other signs of distress present) (102) (104).
- Aspiration with swallowing can only be visualized with an instrumental evaluation of swallowing: Videofluoroscopic Swallow Study (VFSS) or Fiberoptic Endoscopic Evaluation of Swallowing (FEES) (102) (104).
- Instrumental Evaluations of swallowing are conducted to understand the nature and pathophysiology of dysphagia in order to develop a safe feeding management plan (104).

* See Swallowing Studies definition.

* See Dysphagia definition.

Co-regulated Cue-Based Feeding:

- Co-regulated approach to feeding recognizes the impact of the caregiver on the infant's feeding experience. Appropriate supportive interventions are needed to anticipate and respond to the infant's communication cues to ensure safe, functional and pleasurable feeding experiences (12) (105).
- A co-regulated cue-based feeding approach utilizes individualized strategies to affect SSB coordination (rhythm, rate) which may include: supporting organization (determining readiness, NNS, bundling), positioning, adjusting milk flow rate, pacing and imposing breaks (burp or rest) to promote endurance.
- A cue-based approach also helps to determine when to stop a feeding by distinguishing signs of satiation vs decompensation or shut down (12) (15).
- Cue-based feeding is more than responding to infant stress. It involves learning from infant responses to anticipate support needed for successful feeding (105).

- “When cue-based feeding is at its best, the preterm infant is ‘supported to feed’ in an individualized manner through infant-guided co-regulation versus ‘being fed’. Appreciating the difference is at the heart of developmentally supportive care.” (Shaker, 2013, p.407).
- Parent-infant synchrony achieved through co-regulation has been shown to improve neurodevelopmental outcomes for former preterm children (106).

Dysphagia (swallowing dysfunction): A disruption in the ability to safely and effectively move liquid or food from the mouth, through the pharynx and esophagus into the stomach, putting the infant at risk of aspiration (107).

Clinical Indications of Dysphagia (51) (104):

- Inability to handle own oral secretions
- Choking or coughing during/after feeding
- Noisy, “wet” upper airway sounds after individual swallows or increasing noisiness over course of feeding
- Wheezing or stridor
- Multiple swallows to clear single bolus
- Apnea/bradycardia during swallowing
- Cyanosis during feeding
- Unexpected need for supplemental oxygen
- History of frequent upper-respiratory infections or pneumonias

* See swallowing studies definition for information on instrumental evaluations of swallowing.

Gastroesophageal Reflux (GER): A return or backward flow of gastric contents into the esophagus with or without regurgitation. GER is a normal physiologic occurrence that occurs several times a day in healthy infants, children and adults, and usually resolves by 1-2 years of age (108). GER is common in premature infants.

Gastroesophageal Reflux Disease (GERD): Reflux of gastric contents contributing to troublesome symptoms and/or complications, such as poor growth, food refusal, pain, abnormal posturing or arching, grimacing, esophagitis, irritability, sleep disturbances, chronic cough, hoarseness, dysphagia, and respiratory symptoms (61) (108).

Milk Ejection Reflex (MER) “Let Down”: The release of milk generally occurring at the beginning of a breastfeed and several times throughout the feeding.

Non-nutritive Sucking (NNS): Rapid and repetitive sucking bursts and pauses in the absence of nutrient flow to promote state regulation and to satisfy sucking desire (26) (70) (109) (110).

- NNS or “flutter sucking” at the breast shapes the nipple and areola, and stimulates a milk-ejection reflex (“let down”) (111).
- NNS during gavage feedings may stimulate gastric emptying and improve feeding tolerance (26).
- NNS during gavage feedings could occur at the pumped breast or on a soother or finger.
- NNS is associated with a positive impact on behavioural state and organization, SSB coordination, and a reduction in the number of days to reach full oral feeding in premature infants (112) (113) (114).
- A mature-looking NNS pattern does not guarantee nutritive sucking success because the coordination and timing of suck-swallow-respiration during NS is more complex (26) (114).

Nutritive Sucking (NS): Active sucking for the purpose of nourishment.

- NS is complex and significantly more challenging than non-nutritive sucking.
- The rate of NS is slower than NNS as the baby coordinates sucking, swallowing, and breathing.
- Mature nutritive sucking involves rhythmically alternating suction (negative intraoral pressure drawing milk) and expression (compression and stripping force by the tongue against the nipple) (114).
- For the preterm newborn, increasing chronologic age (maturation) and nutritive sucking experience (practice) accelerates the development of nutritive sucking (26) (33) (36).
- Mature feeding performance relies on development of a mature sucking pattern, managing larger boluses, more frequent swallowing and coordination of the swallow-breath sequence (115).

Three components of NS need to be assessed:

1. **Suction and Expression:** is how the infant becomes efficient at milk transfer. Sucking typically progresses sequentially as follows (114) (116):
 - Arrhythmic expression with no suction
 - Rhythmic expression and appearance of arrhythmic suction
 - Emerging rhythmic suction
 - Progression to an alternating pattern of rhythmic suction and expression
 - Alternating pattern of suction and expression with increasing suction amplitude and duration of sucking bursts reflects a mature suction and expression pattern
2. **Sucking Burst Patterns:** length and rhythm of sucking bursts and pauses (117).
 - **Normal Sucking Burst Patterns**
 - Immature:** consists of short sucking bursts (3-5 sucks per burst) with pauses of equal duration. Respirations and swallows occur before and after the sucking burst (118) (119).
 - Mature:** Continuous sucking bursts with only brief pauses between bursts (120). Infant demonstrates good SSB coordination with physiological stability.

- **Abnormal / Transitional Sucking Burst Pattern:** Is a disorganized sucking pattern most often associated with respiratory compromise. It is characterized by inconsistent and variable lengths of bursts with arrhythmic breathing, primarily during pauses. This pattern is often associated with apnea. These infants benefit from pacing (117).
3. **Suck/Swallow/Breathing Coordination (SSB):** Safe feeding requires precise coordination of processes that provide airway maintenance for breathing and airway protection during swallowing. Poor coordination of SSB puts the infant at risk of aspiration, prolonged airway closure, and insufficient rate and depth of breathing (15).
- SSB coordination patterns typically progress as follows (59) (105) (121):
 - Alternating Suck-Swallow with respiration (Immature pattern): In this pattern sucking and swallowing is integrated but separate from breathing. In this pattern respiration is delayed. This may lead to apnea, tachypnea, and fatigue.
 - Integration of sucking, swallowing, and breathing (Mature pattern): In this more efficient pattern, the infant is able to insert breaths into the suck-swallow sequence, allowing for longer sucking bursts while ensuring adequate oxygenation.
 - Maturation of respiration during feeding is not fully established even at 36 weeks PCA (56) or later (59). For some infants, maturation may continue post-discharge (22).
 - SSB coordination patterns not only change as skills evolve, but patterns may also change within an individual feeding as the infant responds to variable feeding conditions (e.g., fatigue, change in flow management) (105).
 - Infants with Bronchopulmonary Dysplasia (BPD) have difficulty integrating respiration into the suck-swallow sequence. As a result, infants with BPD have irregular respiration and increased apnea which emphasizes the need for more frequent breaks, pacing, and close monitoring during feeding (SpO₂/heart rate monitoring) (122) (123).
 - Infants with tachypnea may be susceptible to incoordination resulting in aspiration (124).
 - Assessment of SSB involves careful assessment of each of the components individually as well as the coordination and organization of all the components together (50) (51) (56) (63) (125).

Oral Immune Therapy (OIT): The administration of small amounts of fresh Mother's own breastmilk between the cheek and gum to provide the immune benefits of fresh EBM. If infant is at risk of aspiration, OIT is administered from a cotton swab against the cheek. (See Guideline OIT for full description).

Pacing (breast or bottle): (17) (51) (63) (83) (87) (103) (105) (119) (126)

- Pacing is a strategy to provide co-regulation during feeding. The caregiver assists the infant in appropriately interspersing breaths during sucking bursts to:
 - facilitate organization and rhythmicity
 - decrease fatigue

- provide time for the infant to clear the bolus from the mouth or throat
- Pacing supports respiration by promoting deep breathing. Some infants require the nipple to be removed from the mouth because the nipple remaining in the mouth will continue to stimulate a sucking reflex (87) or may inhibit breathing (127). As a result, the infant will not swallow and take a breath, or will be sucking air on the empty nipple.
- The risks of insufficient pacing may include (12) (17):
 - physiological instability (desaturations, tachypnea, apnea, or bradycardias)
 - coughing, choking, aspiration
 - maladaptive sucking (clamping, loosening latch, excessive compression)
 - limited mouth opening (pursed lips) at breast or bottle
 - decreased intake (shutdown/fatigue)
 - feeding aversion related to repeated negative experiences
- Pacing may also be planned based on previous clinical assessment of the infant's feeding skill and endurance and history of decompensation with feeding (105). Planned pacing is provided consistently to prevent repeated decompensation. Infants requiring planned pacing generally require pacing with nipple removed to lip. Some infants may require a combination of planned and variable pacing throughout the feeding as conditions change for the infant.

Pacing Methods: (51) (83) (103) (105)

1. Nipple removed (breast or bottle): Break suction and remove nipple from mouth. Allow nipple to rest against the infant's lip. Allow the infant to clear the liquid with effective swallowing, take effective recovery breaths, reorganize and cue for readiness to resume sucking. If infant does not open mouth spontaneously, attempt to elicit rooting reflex. Continue oral feeding only if infant demonstrates readiness cues. This allows the infant the choice to resume feeding.
2. Nipple tipped (bottle): Gently and slowly roll infant forward with the bottle in the mouth until the milk is out of the nipple, cuing the infant to pause sucking. Allow the infant to resume effective breathing, reorganize, and cue for readiness before rolling back to fill the nipple with milk again.

Transitioning from nipple removed to nipple tipped (bottle):

- Infant has demonstrated physiological stability with pacing with nipple removed, e.g. not requiring long recovery pauses or multiple swallows when nipple is removed.
- Infant does not continue sucking with nipple tipped, instead infant swallows and pauses to breathe.
- Infant does not demonstrate increased work of breathing, desaturations, bradycardias, tachypnea, and does not pool or lose milk with pacing with nipple tipped.
- Endurance for feeding is not reduced by pacing with nipple tipped instead of removed.

Pumped Breast (see Appropriately Pumped Breast).

Rest Breaks: In addition to pacing, additional rest periods such as burp breaks throughout the feeding may further promote endurance (105). Rest breaks can also help reduce GER events by preventing gulping, allowing gastric emptying and the opportunity for burping (61). **Note:** Breastfed infants may naturally take rest breaks between milk ejection letdowns and may not need to be removed from the breast (126).

Side-Lying Positioning for Feeding (12) (15) (17) (128) (129) (130):

Involves supporting infant in a semi-elevated side-lying position. This mimics the natural breastfeeding position, and allows consistency of positioning for infants who breastfeed and may require bottle feeding. Oral transit time may be decreased and allow the infant time to form a bolus and swallow with increased efficiency and opportunities for recovery breaths.

- Use with pillow under the infant to support breathing and postural stability
- Head should be in midline position with chin slightly elevated (sniff position) to support an adequate airway and good latch
- Arms and legs are supported in flexion with infant swaddled if needed
- If swaddled, leave hands exposed in order to read infant stress cues (e.g. finger splaying) and to allow infant to touch hand to mouth/breast to help organize the infant

SINC (Safe Individualized Nipple Feeding Competence) - Currently a Calgary zone QI and research project.

Swallowing Studies: Instrumental evaluations of swallowing are conducted to understand the nature and pathophysiology of dysphagia in order to develop a safe feeding management plan (104).

- 1) **Fiberoptic Endoscopic Evaluation of Swallowing (FEES)** provides information on vocal cord function and ability to protect the airway with secretions and during feeding. The FEES uses a flexible endoscope placed transnasally to visualize the hypopharynx and larynx allowing for visualization of secretions, liquid, or food that penetrate (above the level of the cords) or are aspirated (material below the level of the cords) prior to and immediately following the swallow (102) (131). Currently it is the instrumental evaluation of swallowing used in our NICU population for infants presenting with dysphagia or suspected vocal cord dysfunction (cry that is hoarse, quiet, or absent). Determining safe introduction or progression of oral feeding is contingent on determining vocal cord function and ability to protect the airway with secretions and liquids. The FEES can also provide valuable information on impact of GERD in a symptomatic infant that also presents with red and swollen pharyngeal structures.

- 2) **Videofluoroscopic Swallowing Study (VFSS)** is a radiographic study that provides dynamic imaging of the oral, pharyngeal and upper esophageal phases of swallowing. Nasopharyngeal reflux, penetration or aspiration of liquid or food prior, during, or following the swallow can be determined. Silent aspiration can also be viewed (102) (104).

Test weighing: An objective method that measures the effectiveness of breastfeeding by weighing the infant before and after breastfeeding to determine the volume of milk ingested. This method has proven feasible in the preterm population as well as more accurate and reliable than clinical indicators (90) (93).

Tube Feeding: Nutritional intake by oral gastric, nasal gastric, nasal jejunal or gastrostomy tube (refer to Guideline: 2-G-1 Gastric Tubes). A tube feeding should take the length of a typical oral feeding (~ 20-30 min.) to allow the stomach to expand slowly, providing a comfortable feeding (83). A combination oral/tube feeding for most infants should take the length of a typical oral feeding session (~ 20-30 minutes).

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ALBERTA HEALTH SERVICES RESOURCES

- Booklet: *Breastfeeding Your Preterm Baby*
- Book: *Healthy Parents Healthy Children: The Early Years*
- 2-G-4 Gastroesophageal Reflux Disease (GERD) Neonatal Management
- 2-G-1 Gastric Tubes
- Booklet: *Breastfeeding Your Preterm Baby*
- 2-S-6 Skin to skin
- 2-C-9 Cue-Based Care
- 2-O-7 Oral Immune Therapy

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