Non-Invasive CPAP Respiratory Support and Establishing Safe Nipple Feeding for Preterm and High Risk Infants

(Breastfeeding, bottle feeding and non-nutritive sucking at the breast while on non-invasive CPAP)

- Infants may require the extended use of non-invasive continuous positive airway pressure (CPAP) for the management of chronic lung disease, apnea of prematurity or due to other conditions (e.g. cardiac, surgical). Many of these infants remain on non-invasive respiratory support at the age when oral feeding would typically be introduced.
- To establish oral feeding, infants need to coordinate their suck, swallow and breathing, a process that is acquired through maturation and experience. The risk of aspiration due to poor suck, swallow and breathe coordination can be mediated with proper feeding techniques such as positioning, external pacing, and the use of slow flow nipples (Lee et al. 2011).
- Historically, the introduction of oral feeding has been delayed until CPAP support is no longer required because of concerns that infants are unable to coordinate their nutritive suck, swallow and breathing, risking aspiration or worsening their respiratory status. Although CPAP does increase glottal opening, it has been found not to affect nutritive swallowing (Boudaa et al., 2013). Recent experiences and literature suggest that the controlled introduction of oral feeding for infants on CPAP can be safe and may accelerate their attainment of oral feeding skills and the achievement of full oral feeding (Hanan et al. 2015, Shetty et al., 2016).

Assessment of Infants Readiness for Oral Feeding or Non-Nutritive Sucking (NNS) at the breast while on Non-Invasive CPAP

Eligibility Criteria

1. Infant ≥ 32 weeks post menstrual age
2. Infant on non-invasive CPAP
3. Physiologically stable
   a. Does not decompensate* if non-invasive CPAP is temporarily displaced
   b. Able to suck on soother without decompensating*
4. Enteral feeds a minimum of 10 mls per feed
5. Able to swallow and manage secretions
6. No plan for transfer within the next 2 days

*Decompensation = bradycardia, apnea and/or SpO2 < 90%

NO → **Not ready for oral feeding**

Irrespective of oral feeding plan, continue:
1. Oral immune therapy (OIT)
2. Non-nutritive sucking (NNS) on *soother*

YES

Medical team discusses (MD/NP) order for OT feeding assessment

Medical team orders OT consult for oral feeding assessment on CPAP

OT consulted and one the following plans established

NO ORAL FEEDING	OT ONLY ORAL FEEDING	SAFE FOR ORAL FEEDS
Non-nutritive sucking (NNS) at pumped breast and/or with soother		Nursing and/or parents to use OT individualized plan for feeding

General guidelines for OT approved nursing and/or parent feeding on CPAP

1. **Refer to individualized OT plan**
2. **REVIEW ELIGIBILITY CRITERIA PRIOR TO EACH FEED**
3. **Provide support for fragile feeders**
   - Position side-lying, bundled with hands in midline
   - Provide non-nutritive sucking (NNS) prior to offering bottle nipple
   - Use Dr. Brown's preemie nipple
   - Monitor suck, swallow, breathing coordination and provide external pacing as needed
4. **Stop oral feeding, notify medical team and OT if during feeding there is:**
   - Tachycardia, tachypnea or oxygen desaturation
   - Aspiration signs (e.g. cough, bradycardia) or signs of distress such as arching or gagging
5. **Breastfeeding**
   - For the mom who is able, breastfeeding should be the first mode offered
   - *At every opportunity, breast is best*
   - Breastfeeding stages will frequently be ahead of bottle feeding stages
   - Test weights may be considered for assessment of milk transfer
   - Milk transfer volume can be also be assessed by comparing post-feed pumping volumes to usual pumping volumes
6. **Discharge:** SickKids OT will contact the accepting units OT to discuss oral feeding plan. If no OT is available, discussion with the accepting physician recommended. Inform parents that oral feeding on CPAP may be discontinued post transfer and is unit dependent.

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References and Main Points

1. Boudaa N., Samson N., Carriere V., Germim P.S., Pasquier J., Bairam A., Praud J., (2013). Effects of caffeine and/or nasal CPAP treatment on laryngeal chemoreflexes in preterm lambs. J Appl Physiol, 114:637-646.
   - Laryngeal chemoreflexes (LCR): reflexes triggered by contact between liquid and laryngeal mucosa and are primarily aimed at preventing tracheal aspiration
   - nCPAP is known to dilate the supraglottal larynx and increase glottal opening
   - query increased risk of tracheal aspiration with nCPAP but nCPAP may directly alter the function of the laryngeal chemoreceptors responsible for LCR such that their response is blunted
   - nCPAP (up to 10cmH2O) does not affect nutritive swallowing (non-nutritive swallowing is decreased by nCPAP)

2. Dalgleish, S.R., Kostecky, L.L., Blachly, N. (2016). Eating in "SINC": Safe individualized nipple-feeding competence, a quality improvement project to explore infant-driven oral feeding for very premature infants requiring noninvasive respiratory support. Neonatal Network, 35(4); 217-227.
   - Offer "therapeutic tasting" at breast or with drops of milk on soother, OT consult if baby ready for bottle or breast and still on CPAP
   - Offering oral feeds(breast or bottle) based on readiness not GA or CPAP status; can orally feed if stable and showing readiness, stop immediately if disengagement signs seen (brady, desats, loss of state, worsening resp status)
   - Readiness skills include; managing secretions, state regulation, physiologic stability, endurance, non-nutritive sucking (NNS), hunger cues, functional SSB coordination (may need feeder assistance)
   - No clinical or radiographic evidence of aspiration
   - Resulted in practice change and implementation of SINC protocol regarding of noninvasive respiratory support

3. Ferrara L., Bidiwala A., Sher I., Pirzada M., Barlev D., Islam S., Rosenfeld W., Crowley C.C., and Hanna N. (2017) . Effect of nasal continuous positive airway pressure on the pharyngeal swallow in neonates. Journal of Perinatology, 00;1-6.
   - Clinically occult aspiration on nCPAP via RAM cannula, also aspirated when on low flow O2
   - Fed using regular flow nipple, no modifications
   - Babies had been received 50% of feeds orally by nursing prior to study

4. Fucile S., McFarland D.H., Gisel E.G., Lau C. (2002). Oral and nonoral sensorimotor interventions facilitate suck-swallow-respiration functions and their coordination in preterm infants. *Early Hum Dev.* 88: 345-50.

5. Hanin M., Nuthakki S., Malkar M.B., Jacherla S.R., (2015). Safety and efficacy of oral feeding in Infants with
   - BPD on nasal CPAP. Dysphagia, 30; 121-127.
   - Two groups compared based on MD preference; 1/2 orally fed on CPAP, ½ no oral feeding on CPAP
   - No adverse effects found when babies bottle fed on nCPAP by Occupational Therapist
   - Babies fed on CPAP achieved full oral feeding sooner
   - No significant adverse effects/no aspiration

6. Jadcherla S.R., Hasenstab K.A., (2016). Effect of nasal noninvasive respiratory support methods on pharyngeal provocation-induced aerodigestive reflexes in infants. American Journal of Physiology Gastrointestinal and Liver Physiology, 1:310(11); G1006-G1014.
   - Pharyngeal stimulation activates several airway-protective reflexes that modulate safe swallowing sequences and respiratory adaptation
   - Responses include pharyngeal reflexive swallowing(PRS), pharyngo-upper esophageal sphincter contractile reflex(PUCR), pharyngo-lower esophageal sphincter relaxation reflex (PLESRR), deglutition apnea and adaptive respiratory changes.
   - NIRS vs controls – feeding milestones delayed, UES nadir pressures and esophageal propagation characteristics not likely clinically different, UES reflex and LES relaxation characteristics were similarily developed
   - LES pressures are comparable to controls so GERD is not a concern
   - Infants capable of initiating PRS in response to bolus
   - Study supports "controlled and regulated" oral feeding during nCPAP or high-flow nasal cannula

7. Lee J.H., Chang Y.S., Yoo H.S., Ahn S.Y., Seo H.J., Choi S.H., Jeon G.W., Koo S. H., Hwang J.h., Park W.S., (2011) Swallowing dysfunction in very low birthweight infants with oral feeding desaturation. World J Pediatr 7:337-343.
    - Significant oral feeding desaturation = one or more episodes of SpO2 below 80% for 15 sec with bradycardia
    - 41 VLBW infants with sig. oral feeding desaturation: 31.7% no abnormality on MBS, 68.3 abnormality
    - 26.8% impaired airway protection – 60% of these < 25weeks GA
    - 41.5% other issues (weak suck, decreased pharyngeal peristatsis, NP reflux, GE reflux)
    - Intervention for impaired airway protection; pacing, positioning, modified nipple flow rate to facilitate safe swallowing.
    - Infants born at lower gestational age have higher rate of impaired airway protection

8. Shetty S., Hunt K., Douthwaite A., Athanasiou M., Hickey A., Greenough A. (2016). High-flow nasal cannula oxygen and nasal continuous positive airway pressure and full oral feeding in infants with bronchopulmonary dysplagia. *Arch Dis Child Fetal Neonatal Ed*.101:408-411.