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Feeding in the NICU and Issues That Influence Success

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Abstract

Premature infants are both medically fragile and immature; both of these factors influence their ability to safely feed. Speech-language pathologists (SLPs) working with these infants must recognize normal development of feeding skills as well as diagnose feeding problems and develop individualized treatment plans. Assessments should include all three phases of swallowing (oral, pharyngeal, and esophageal) in the context of overall stability, and interventions need to be individualized to the unique needs of each infant. Decreasing the flow rate of fluid and providing pacing are frequently used strategies to support the medically fragile infant. Therapeutic programs that do not appreciate the role of both individual developmental progression and medical comorbidities are not appropriate, given that volume is not the only goal of feeding. Rather, SLPs must focus on skill acquisition for long-term success within the larger context of parental nurturing. Medical comorbidities significantly influence both the initiation and the progression of oral feeding in this population. The individual variation in development, as well as the medical fragility in this population, challenges the neonatal intensive care unit (NICU) therapist to appreciate the complexity of feeding and to work in collaboration with the other members of the team.

Introduction

The speech-language pathologist (SLP) in a neonatal intensive care unit (NICU) will spend a considerable amount of time supporting infants in the area of feeding. To do so, the therapist must understand normal feeding development and identify infants whose feeding behaviors are atypical. Therapeutic interventions must be individualized to the infant's specific developmental stage and medical condition, because comorbidities directly influence the transition to and success in oral feeding. NICU-based SLPs face unique challenges in supporting feeding for this population.

Feeding is a complex activity that is influenced by both physiologic stability and maturation. The term infant is born with a mature physiologic system and quickly transitions to oral feeding; the premature infant often lacks the stability and skill to coordinate sucking, swallowing, and breathing. While there is an expectation that feeding occurs prior to term, the gestational age (GA) when feeding matures is influenced by both individual variation and medical comorbidities. Therapeutic interventions that do not consider the individuality of the infant or the interaction between the infant and the caregiver lack a holistic understanding of the complexity of

feeding. Feeding is seen as a unique opportunity for nurturing that is not accomplished through any other caregiving task and one that influences parents' views of competence in parenting (Pridham, Lin, & Brown, 2001). The goal of the SLP should be to provide assessments and interventions that maintain stability during the feeding, in collaboration with the infant, the family, and the other members of the NICU team.

Physiologic stability is the foundation of oral feeding. Feeding disrupts respiration; therefore, respiratory effort must be considered during oral feeding (Porges, 1996). Infants with lung disease or other physiologic comorbidities (e.g., digestive) are at highest risk for long-term feeding disorders (Rommel, De Meyer, Feenstra, & Veereman-Wauters, 2003). Motor stability underlies successful feeding as well, and oral-motor skills develop in an organized, observable progression for the healthy preterm infant, but are negatively influenced by medical comorbidities. Feeding also requires the ability to alert, maintain stability in other areas, and focus on feeding. In Als' Synactive Theory, these systems communicate and a disruption in one system negatively affects stability in the other systems (Als, 1982). The Synactive Theory has been integrated as a foundation for feeding models (Pickler, 2004). The NICU therapist must strive for infant stability before, during and after any interaction.

SLPs in the NICU may provide developmental support for the preterm infant during feeding development and provide individualized interventions for infants who have feeding difficulties (Fletcher & Ash, 2005; Shaker & Woida, 2007). There are several frameworks that assist the therapist in providing developmental feeding support for the preterm infant. One such framework is the Baby Regulated Organization of Systems and Sucking (BROSS; Ross & Browne, 2003). The BROSS is an eight-step progression that uses stability across physiologic, motor, and arousal (state) systems as well as observable feeding behaviors to monitor progression towards competent feeding. The NICU therapist can use the BROSS framework along with individualized assessments to guide decisions regarding initiation and progression in feeding. The healthy, preterm infant will progress up the BROSS steps, from stability in the bed to organized feeding. The SLP can also identify those infants who are not progressing as expected and develop therapeutic interventions to support movement up the steps. Therapists need to consider the progression within the context of both individual variation and medical comorbidities that directly influence the time it takes to transition to oral feedings (Frakaloss, Burke, & Sanders, 1998; Mandich, Ritchie, & Mullett, 1996). Research consistently indicates the mean GA to transition to full oral feedings is 36 to 37 weeks, despite the use of therapeutic interventions designed to speed the process in preterm infants (Amaizu, Shulman, Schanler, & Lau, 2008; Fucile, Gisel, & Lau, 2005; Medoff-Cooper, 2005). Preterm infants should not be considered delayed simply because they lack a mature suck, swallow, and breathe pattern. Much like age-correcting for other developmental milestones, the ability to orally feed should be considered within the context of development. Preterm infants do typically demonstrate an observable, predictable progression leading to a fully integrated, mature feeding pattern. Therefore, SLPs should identify and assess infants who are not following this normal progression. The oral phase of feeding can be evaluated with non-nutritive sucking (NNS) and all three phases of feeding (oral, pharyngeal and esophageal) with nutritive sucking (NS; Darrow & Harley, 1998).

Evaluation of Feeding Skills

Bedside evaluations should begin with an assessment of stability during NNS. The therapist can evaluate rooting and latching, as well as the integration (or lack thereof) of suction and compression during NNS. If compression is present without suction, the pacifier will fall out of the mouth as the infant compresses the nipple. In contrast, the pacifier will remain firmly in the mouth and the infant will resist attempts at removal if both components are integrated. Infants who lack suction when given the pacifier may be immature or may have a structural defect (e.g., cleft palate). An immature infant may demonstrate compression-only sucking because suction lags behind compression in development (Lau, Alagugurusamy, Schanler, Smith, & Shulman, 2000). If the infant is developmentally immature, opportunities for NNS positively affect both behavioral state and physiologic organization and will promote physiologic stability (Pinelli & Symington, 2005). However, if the infant is older and all other systems appear to be stable and mature, the therapist should rule out a structural defect and/or consider using a compression bottle system if poor suction and compression are observed. These special bottle systems facilitate flow and compensate for the lack of suction, but may interfere with the integration of suction in the immature infant (Chang, Y. J., Lin, C. P., Lin, Y. J., & Lin, C. H., 2007). Pending stability during the oral phase of feeding, nutritive sucking with the added requirements of pharyngeal and esophageal phases should be evaluated.

Infants must coordinate sucking, swallowing, and breathing (SSB) to safely feed during NS, which is more complex than NNS. The rate, strength, and coordination of the SSB sequence should be evaluated by offering the infant a standard bottle nipple unless there is reason to choose a slower or faster flowing nipple. If the therapist is concerned about the infant's ability to tolerate volume, a taste of formula or breast milk may be offered, using either a pacifier dipped in fluid or a pacifier system/bottle system designed to severely limit flow rate. The assessment should focus on the ability to express fluid, while integrating swallowing and breathing and maintaining stability. A number of assessment schema are available to the therapist to evaluate feeding, although the psychometric properties of formal assessments are weak (da Costa, van den Engel-Hoek, & Bos, 2008; Howe, Lin, Fu, Su, & Hsieh, 2008). The therapist should be able to recognize infant signs of instability while feeding, and volume of fluid should be only one part of an assessment.

As noted above, the NS assessment examines both the oral and pharyngeal phases of feeding. Poor abilities in either phase may result in (a) inefficient feeding, (b) loss of fluid, (c) poor coordination of swallowing and breathing, or (d) choking. The therapist must assess the etiology for any of these and understand the role of flow rate in each phase. Fluid loss, limited jaw and tongue excursions, and the use of compression-only sucking may be compensatory strategies purposefully engaged by the infant to decrease flow rate during NS and to safely manage fluid in both the oral and pharyngeal phases (Eishima, 1991). Inappropriately increasing flow rate in the medically fragile infant may disrupt the development of suction and result in a loss in overall feeding skills and volume. Alternatively, the infant with a poor oral phase of feeding may benefit from increased flow rate. Flow rate is an important variable to consider during both the assessment and the development of interventions.

Some infants continue to have difficulty with NS despite alterations in flow rate and may benefit from further instrumental swallow evaluation (e.g., modified barium swallow study). However, the evaluation must be conducted within the context of normal development. Currently data are lacking to guide when it might be appropriate

for a premature infant (who, in a normal developmental course, would not be required to orally feed) to swallow without compromising the airway. Aspiration damages the lungs and should always be avoided, but the SLP must consider whether an instrumental evaluation is appropriate or whether a clinical trial intervention is a better option (e.g., supplemental feedings in lieu of oral feedings for 5-7 days to assess primary aspiration). Instrumental evaluations should be conducted within the context of development and, in the absence of normative data, should be reserved for infants who are close to term gestation. It may be important to consider that deficits in the esophageal phase may negatively influence the oral and pharyngeal phases, and once esophageal phase function is normal, the oral and pharyngeal problems may improve significantly (Dusick, 2003). Therapists must develop specific therapeutic interventions for those infants who are feeding poorly; the majority of these infants will have medical comorbidities.

Therapeutic Interventions

The goal of all therapeutic interventions is to increase overall stability while supporting both skill development and the safe consumption of nutrition. Interventions may include environmental modifications, such as decreasing stimuli around the infant during feedings and adjusting activities to conserve energy. Swaddling may support the motor system and facilitate flexion, while decreasing extraneous, unproductive movements. Specific therapeutic interventions may address difficulty with (a) expressing fluid (oral phase), (b) achieving a safe swallow (pharyngeal phase), or (c) the esophageal phase of swallowing.

Two frequently used therapeutic interventions for assisting the oral and pharyngeal phases include decreasing flow rate and/or interrupting the flow of fluid with pacing. Many infants are unable to efficiently ingest appropriate volumes in the early stages of feeding, but become more efficient as they mature (Amaizu et al., 2008; Medoff-Cooper, 2005). Unfortunately, interventions that focus solely on volume (both total volume and volume/minute) may not consider the physiologic stability of the infant and may be counterproductive. Chang, Lin, Lin, and Lin (2007) used a cross-over design to evaluate the effects of a cross-cut nipple (faster flow rate) versus a single-hole nipple (standard rate) on feeding and stability in a study of 20 stable preterm infants who were admitted to a level II nursery in a tertiary care center. The standard-rate nipple resulted in improved physiologic stability with a more efficient sucking pattern, resulting in greater volume in the feeding (Chang et al.). NICU-based therapists should consider slowing the flow rate to one that is easily managed by the infant.

Flow rate should be increased only when doing so assists the infant in ingesting appropriate volume, while maintaining physiologic stability and facilitating oral-motor skill. Infants with congenital conditions affecting the oral phase of the swallow may benefit from increased flow rate, which can be accomplished with a faster flowing nipple/bottle system or the use of oral supports, such as stabilizing the jaw and tongue with chin and/or cheek support (Hill, Kurkowski, & Garcia, 2000.) However, therapists need to consider that these same infants may have difficulty with coordinating a safe swallow and experience deficits in the pharyngeal phase when the flow rate is increased.

Pacing is also a commonly used intervention, with the caregiver interrupting the flow of the fluid by facilitating an alternating rhythm of 3-5 sucks followed by a

respiratory break, thereby proactively avoiding feeding-induced apnea. Pacing with preterm infants results in fewer episodes of physiologic instability and increased efficiency in oral-motor patterns at discharge (Law-Morstatt, Judd, Snyder, Baier, & Dhanireddy, 2003). Both a slower flow rate and external pacing should be considered when working with the medically fragile infant.

For the infant who is not able to maintain stability and/or a safe swallow despite altered flow rate and pacing, a therapist will often consider thickening feedings based upon the swallow assessment. Thickening of feedings to facilitate safe swallows in preterm infants is not without controversy, due to concerns regarding how the immature gut tolerates thickening agents such as rice cereal or commercial thickening agents (Patole, 2007). Thickening of feedings should be considered for the mature infant who is unable to achieve a safe swallow after other therapeutic interventions have been exhausted.

Influence of Medical Comorbidities

While prematurity is a significant risk factor for feeding difficulties, infants with respiratory and digestive problems are most at-risk for long-term feeding problems (Field, Garland, & Williams, 2003; Rommel et al., 2003). Both of these organ systems support physiologic stability, and, without this underlying stability, the infant's experience of feeding may be aversive and may lead to long-term feeding issues. Respiratory difficulties can alter both the progression towards full oral feedings and the oral-motor feeding pattern itself, because they negatively influence the ability to coordinate SSB (Gewolb & Vice, 2006). Infants with either respiratory or cardiac conditions often become hypoxic (with and without apnea), and are frequently fatigued and irritable. Decreasing flow rate and volume, while increasing caloric density and/or frequency of nipple feeds, may be appropriate interventions for the infant with respiratory and/or cardiac comorbidities, as is close collaboration with a pediatric nutrition specialist (Gewolb & Vice). Another medical comorbidity that influences the time to transition to oral feedings is gastroesophageal reflux (GER; Frakaloss et al., 1998), one of the most common comorbidities for infants referred to feeding clinics (Rommel et al.). Thickening of feedings for the treatment of gastroesophageal reflux in preterm infants is also controversial (Corvaglia et al., 2006; Patole, 2007), but is often recommended for the term infant who has uncomplicated reflux (Chang, Lasserson, Gaffney, Connor, & Garske, 2006). Smaller volumes and more frequent feeds may also be appropriate (Poets, 2004).

Summary

Preterm infants are both medically fragile and immature. This combination influences the timing and progression of oral feeding development. Infants with comorbidities are especially vulnerable to disruptions in the progression of oral skill development. Preterm infants are not delayed term infants; rather, preterm infants may be developmentally normal in the context of their gestational age. The goal of the SLP in the NICU is to facilitate oral feeding by supporting stability as well as a normal developmental progression, while devising individualized therapeutic interventions for those infants who are not acquiring normal feeding skills. Slowing the flow rate and pacing the feeding are two common strategies used in the NICU. Therapists should reserve faster flowing and compression-only bottle systems and oral-motor supports for those infants who are able to maintain physiologic stability while tolerating

increased flow. Long-term success depends on a foundation of physiologic stability and skill acquisition, rather than on volume alone.

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