

Relationship Between Duration of Tube Feeding and Success of Oral Feeding in Preterm Infants

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ABSTRACT

Objective: Primary: to identify the potential relationship between duration of tube feeding and success of oral feeding in preterm infants; secondary: to identify the potential relationships among duration of tube feeding and alert behavioral states, orally directed behaviors, and nutritive sucking.

Design: A descriptive correlational study.

Setting: A Level III NICU at an inner-city hospital.

Participants: Twenty-eight preterm infants who were born between 28 and 32 weeks gestational age, were clinically stable, and were expected to have at least 1 week of tube feeding during their initial hospitalizations.

Methods: Data were collected daily from participants' electronic medical records and at one-time oral feeding evaluations within 48 hours after the removal of the feeding tube.

Results: We found a significant negative correlation between duration of tube feeding and oral feeding success ($p = .000$). We found no correlations between duration of tube feeding and alert behavioral states, orally directed behaviors, or nutritive sucking.

Conclusion: Although the duration of tube feeding is a nonmodifiable factor, preterm infants who are anticipated to have extended durations of tube feeding may be at risk for delayed oral feeding success.

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As many as 150,000 infants are born very premature (<32 weeks gestational age) each year in the United States (Martin, Hamilton, Osterman, Driscoll, & Mathews, 2017; U.S. Department of Health and Human Services, 2015). These infants require admission to the NICU (March of Dimes, 2016; World Health Organization, 2015) and may experience prolonged hospitalizations. One criterion for hospital discharge is the achievement of oral feeding success (OFS; American Academy of Pediatrics, 2008). OFS is defined as an infant's ability to consume 100% of the prescribed volume by mouth (Griffith, Rankin, & White-Traut, 2017; Maron et al., 2015; Maron, Johnson, Dietz, Chen, & Bianchi, 2012). However, because of physical and neurological immaturity, approximately 40% to 70% of preterm infants are often challenged to achieve OFS (Rudolph & Link, 2002) and may need extended tube feeding (Bingham, Ashikaga, & Abbasi, 2011).

The presence of alert behavioral states, orally directed behaviors, and nutritive sucking patterns consistently predicted OFS (Griffith et al., 2017; White-Traut et al., 2017). Alert behavioral states are characterized by open eyes, focused attention, searching movements of the eyes, quiet inactivity or movement of the extremities, and strong muscle tone (Griffith et al., 2017). Orally directed behaviors include mouthing, rooting, tonguing, empty sucking, swipes at mouth, hand to mouth, sucking on tongue, and sucking on hand (White-Traut, Rankin, Pham, Zhuoying, & Liu, 2014). A mature nutritive sucking pattern is shown by an increase in the number of sucks, sucks per burst, sucking pressure, and shorter interburst width or length of time between sucking bursts (Medoff-Cooper, Bilker, & Kaplan, 2010). These predictors of OFS are often demonstrated by preterm infants who are actively engaged before and during oral feeding episodes (Kirk, Alder, & King, 2007). Thus, oral feeding is an

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Although tube feeding is necessary for many preterm infants, the relationship between duration of tube feeding and oral feeding success is not well understood.

active process that is learned and refined with oral feeding experience and that allows an infant to achieve OFS (Pickler, 2004).

Although oral feeding is an active process, tube feeding is a passive process, and preterm infants are tube fed according to a schedule and with a prescribed volume (Kirk et al., 2007). When an infant begins the transition to oral feeding, he or she needs the opportunity to develop a pattern of orally directed behaviors shown before feeding and alert behavioral states maintained before and during feeding. The current recommendation is to implement infant-directed feeding and allow preterm infants to feed orally as early and as often as they exhibit signs of readiness (Horner et al., 2014; Jadcherla et al., 2012; Shaker, 2012). However, an infant-directed feeding approach is often not implemented or is implemented incorrectly in many NICUs. Currently, the common practice in the NICU setting is scheduled feeding with a prescribed volume. Researchers found that during the transition from tube to oral feeding, some preterm infants received tube feedings instead of oral feedings for reasons that were unrelated to the infants' readiness or ability to oral feed, including time management and other reasons (Tubbs-Coolley, Pickler, & Meinzen-Derr, 2015). Thus, the opportunity to learn and refine the active oral feeding process that involves alert behavioral states, orally directed behaviors, and nutritive sucking may be delayed (Dodrill et al., 2004). However, the relationships between the duration of tube feeding and alert behavior states, orally directed behaviors, and nutritive sucking during initial hospitalization are not well understood.

Although tube feeding is necessary to maintain adequate caloric intake for growth and development (Lau, Geddes, Mizuno, & Schaal, 2012), it can have negative effects. For example, insertion of a feeding tube induces unpleasant reactions, such as pain, choking, and gagging, and may contribute to oral stimulation hypersensitivity, which results in discomfort and rejection of a new oral stimulus (Mason, Harris, & Blissett, 2005). Recently, researchers found that nonnutritive sucking measures (e.g., number of sucks, number of bursts, and burst organization score) decreased during tube feeding compared with

the time before tube feeding (Bingham et al., 2011). Researchers also found that preterm infants who were tube fed during initial hospitalizations were at greater risk for impaired oromotor function and coordination, oral sensitivity, facial defensiveness, oral feeding difficulties, and oral aversion after discharge (Dodrill et al., 2004). Nonetheless, little evidence exists with regard to the relationship between the duration of tube feeding and OFS in preterm infants during initial hospitalizations.

The primary purpose of our study was to identify the potential relationship between the duration of tube feeding and OFS in preterm infants during their initial hospitalizations. A secondary purpose was to identify the potential relationships among the duration of tube feeding and alert behavioral states, orally directed behaviors, and nutritive sucking at a one-time oral feeding evaluation within 48 hours after the removal of the feeding tube.

Methods

Design and Setting

A descriptive correlational study was conducted in a Level III NICU at an inner-city hospital in the midwestern United States. All preterm infants in the study received the study site's standard of care. The nurses and physicians decided when to initiate and advance oral feeding. We followed each preterm infant throughout his or her initial hospitalization, and within 48 hours after the removal of the feeding tube, we evaluated the infant's oral feeding. The hospital institutional review board approved the study. Mothers gave written informed consent for their infants' participation in the study.

Sample

We included infants who were born between 28 and 32 weeks gestational age (GA), were clinically stable, and were expected to have at least 1 week of tube feeding during their initial hospitalizations. The exclusion criteria were a diagnosis of necrotizing enterocolitis, sepsis, Grade III or IV intraventricular hemorrhage, periventricular leukomalacia, cardiovascular defects, congenital anomalies of the oral cavity, gastrointestinal defects, and/or chromosomal abnormalities.

We estimated the sample size from the mean percentage oral intake, which was a representative measure of OFS (primary outcome) and reported as 59.4% (standard deviation [*SD*] = 34.8;

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