6. Van Dienst PJ, Holzel H, Burnett D, Crodker J. Impactitis: new cures for an old disease. J Clin Pathol. 2001;54:817-9.
7. Braun T, Glanzel W, Grupp H. The scientometric weight of 50 nations in 27 science areas 1989-93. Part II. Life Sciences. Scientometrics. 1996;34:207-37.
8. Abbasi K. From impact factor to influence, a PowerPoint presentation. http://bmj.bmjjournals.com/talks/journal_impact_and_influence/index_files/frame.htm.

Surface electromyography of facial muscles during natural and artificial feeding of infants: identification of differences between breast-, cup- and bottle-feeding

Kerstin H. Nyqvist,[1] Uwe Ewald[2]

The authors have chosen to study a topic that has not yet received adequate attention, but regarding which there are conflicting opinions. By their choice of method they have been able to provide an answer of clinical relevance to a previously unanswered question: Which alternative oral feeding method should be used for supplementation of breastfed infants?

According to current recommendations from the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF),[1] health workers should protect, promote and support exclusive breastfeeding for 6 months and continued breastfeeding up to 2 years of age or beyond. However, exclusive breastfeeding is not an option for all infants for several reasons. Newborn infants who need supplementation for medical reasons and infants with partial breastfeeding require feeding by an alternative method. Because of the negative impact of feeding nipples on the development of infant sucking behavior and the deleterious impact of bottle feeding in hospital on mothers' subsequent choice of feeding method, the "Ten steps to successful breastfeeding" include step 9: "Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants."[2] The main reason for the "ban" on bottle feeding is the assumption that it causes "nipple confusion": the infant will have difficulties in sucking on the mother's breast after having learnt to suck on an artificial nipple.

See related article on page 103

Cup feeding has been used for feeding infants and young children as far back in history as we have any insight. Presently, cup feeding is regarded in most settings as the superior alternative method for feeding infants in neonatal units. Already in 1987, a cup feeding policy feeding preterm infants in Kenya was presented.[3] Similar policies were introduced in the UK[4,5] and in South Africa.[6] Research in India has demonstrated very early capacity for efficient cup feeding in very preterm infants.[7,8] Preterm infants show more physiologic stability during cup feeding when compared with bottle feeding.[9-11] Preterm infants randomized to cup-feeding instead of bottle feeding were more likely to be discharged home with full breastfeeding.[12]

For supplementation of term infants in maternity units, opinions vary. No differences were noted in breastfeeding at discharge in a maternity unit in the UK in which babies were supplemented by cup or bottle.[13] The authors concluded that at least these babies were not affected by nipple confusion. It should be noted that this was a retrospective uncontrolled study. A randomized trial also failed to find any differences in breastfeeding outcome depending on whether the infants were supplemented by cup or bottle.[14] However, also term infants are more physiologically stable during cup feeding in comparison with bottle feeding.[15]

It appears that hesitation to use cups may partly be attributed to staff resistance to new procedures.[16] A

1. RN, PhD, Assistant Professor, Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden.
2. MD, PhD, Professor, Department of Women's and Children's Health, University Children's Hospital, Uppsala, Sweden.

Suggested citation: Nyqvist KH, Ewald U. Surface electromyography of facial muscles during natural and artificial feeding of infants: identification of differences between breast-, cup- and bottle-feeding. J Pediatr (Rio J). 2006;82:85-6.

doi:10.2223/JPED.1452

practice that needs careful consideration is the use of an indwelling tube during the whole process of infants' transition from enteral to oral (breast/bottle) feeding, considering the increased risk of aversive feeding behavior later on.[17] Another, more important reason for hesitation about the use of cup feeding – according to verbal communication with speech therapists – is the opinion that cup feeding deprives the infant of opportunities for training muscles involved in oral feeding, necessary to prevent later feeding problems; instead these professionals commonly recommend bottle feeding. However, until now, no evidence has been presented that supported or refuted this assumption.

Electromyography (EMG) has been used in a few studies to explore normal infant sucking behavior. The development of activities in the temporalis, masseter, orbicularis oris, and suprahyoid muscles were described in infants aged from 1 to 5 months.[18] The co-ordination of the same muscles has been explored during bottle feeding.[19] We used EMG to investigate early sucking competence in preterm infants during breastfeeding.[20] Similarly to the above mentioned authors, we found that m. orbicularis oris, one of the buccinator muscles, was very actively involved in sucking. We were only able to identify one study that investigated differences in muscle activity depending on feeding method.[21] In this EMG study of the masseter muscles in breastfed and bottle-fed babies, lower muscle activity was observed in bottle-fed babies.

In their study, Gomes et al. applied detailed analysis of EMG data derived from the masseter, temporalis and buccinator muscles.[22] We presuppose that they selected the chosen EMG technique (filtering) for the data collection based on consideration of exclusion of artefacts, etc. The similarities between, and the wider range and mean contraction of the masseter and temporalis muscles in breastfed and cup-fed infants, compared with what was noted during bottle-feeding, as well as the opposite results for the buccinator muscle demonstrate the superiority of cup-feeding when compared to bottle-feeding as an alternative oral feeding method. This finding gives certain support to the assumption about nipple confusion in breastfed infants after exposure to bottle feeding. For breastfeeding counselors, the finding of similar muscle activities during breast- and cup-feeding is most welcome, as it will facilitate the provision of breastfeeding-friendly advice to professionals and mothers regarding supplementation of breastfed infants.

References

1. World Health Organization, United Nations Children's Fund. Global strategy for infant and young child feeding. Geneva: WHO; 2003.
2. United Nations Children's Fund. Innocenti declaration on the protection, promotion and support of breastfeeding. Florence: UNICEF; 1990.
3. Armstrong HC. Breastfeeding low birthweight babies: advances in Kenya. J Hum Lact. 1987;3:34-7.
4. Lang S, Lawrence CJ, Orme RL. Cup feeding: an alternative method of infant feeding. Arch Dis Child. 1994;71:365-9.
5. Jones E. Breastfeeding in the preterm infant. Modern Midwife. 1994;1:22-6.
6. Spiro A, Robinson J. Promoting breastfeeding in a hospital neonatal unit. Health Visit. 1994;67:169.
7. Gupta A, Khana K, Chattergee S. Cup feeding: an alternative to bottle feeding in a neonatal intensive care unit. J Trop Pediatr. 1999;45:108-10.
8. Malhotra N, Vishwambaran L, Sundaram KR, Narayanan I. A controlled trial of alternative methods of oral feeding in neonates. Early Hum Dev. 1999;54:29-38.
9. Marinelli KA, Burke GS, Dodd VL. A comparison of the safety of cupfeedings and bottlefeedings in premature infants whose mothers intend to breastfeed. J Perinatol. 2001;21:350-5.
10. Rocha NMN, Martinez ME, Jorge SM. Cup or bottle for preterm infants: effects on oxygen saturation, weight gain, and breastfeeding. J Hum Lact. 2002;18:132-8.
11. Dowling DA, Meier PP, DiFiore JM, Blatz M, Martin RJ. Cup-feeding for preterm infants: mechanics and safety. J Hum Lact. 2002;18:13-20.
12. Collins CT, Ryan P, Crowther CA, McPhee AJ, Paterson S, Hiller JE. Effect of bottles, cups and dummies on breast feeding in preterm infants: a randomised controlled trial. BMJ. 2004;329:193-8.
13. Brown SJ, Alexander J, Thomas P. Feeding outcome in breast-fed term babies supplemented by cup or bottle. Midwifery. 1999;15:92-6.
14. Howard CR, Howard FM, Lanphear B, Eberly S, de Blieck EA, Oakes D, et al. Randomized clinical trial of pacifier use and bottle-feeding or cup-feeding and their effect on breastfeeding. Pediatrics. 2003;111:511-8.
15. Howard CR, de Blieck EA, ten Hoopens CB, Howard FM, Lanphear BP, Lawrence RA. Physiologic stability of newborns during cup and bottle feeding. Pediatrics. 1999;104:1204-7.
16. Cloherty M, Alexander J, Holloway I, Balvin K, Inch S. The cup-versus-bottle debate: a theme from an ethnographic study of the supplementation of breastfed infants in hospital in the United Kingdom. J Hum Lact. 2005;21:151-62.
17. Mason SJ, Harris G, Blisset J. Tube feeding in infancy: implications for the development of normal eating and drinking skills. Dysphagia. 2005;20:46-61.
18. Tamura Y, Matsushita S, Shinoda K, Yoshida S. Development of perioral muscle activity during suckling in infants: a cross-sectional and follow-up study. Dev Med Child Neurol. 1998;40:344-8.
19. Tamura Y, Horikawa Y, Yoshida S. Co-ordination of tongue movements and peri-oral muscle activities during nutritive sucking. Dev Med Child Neurol. 1996;38:503-10.
20. Nyqvist KH, Farnstrand C, Edebol Eeg-Olofsson K, Ewald U. Early oral behaviour in preterm infants during breastfeeding: an EMG study. Acta Pediatr. 2001;90:658-63.
21. Inoue N, Sakashita R, Kamegai T. Reduction of masseter muscle activity in bottle-fed babies. Early Hum Dev. 1005;18:185-93.
22. Gomes CF, Trezza EMC, Murade ECM, Padovani CR. Surface electromyography of facial muscles during natural and artificial feeding of infants. J Peditar (Rio J). 2005;82:103-9.