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-COVER PAGE-

ACTIFIER II: THE DYNAMICS OF NON-NUTRITIVE SUCK IN NEONATES AND INFANTS

Lana Seibel[1]	lseibel@ku.edu	785-864-1196 785-864-4403
Steven Barlow[1]	smbarlow@ku.edu	785-864-0632 785-864-4403 FAX
Don Finan[2]	don.finan@colorado.edu	303-492-3078 303-492-3274 FAX
Susan Stumm[1]	sstumm@ku.edu	785-864-1196
Shiva Ponnaboyina[1]	shivap26@ku.edu	785-864-1196
Raghavendra Shantha[1]	raghu@ku.edu	785-864-4539

[1]Communication Neuroscience Laboratories
1000 Sunnyside Avenue
DOLE 3001
University of Kansas
Lawrence, KANSAS 66045-7555

[2]Department of Speech, Language, and Hearing Sciences
2501 Kittredge Loop Road, Campus Box 409
University of Colorado
Boulder, CO 80309-0409

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Abstract: ACTIFIER II: THE DYNAMICS OF NON-NUTRITIVE SUCK IN NEONATES AND INFANTS

Lana Seibel[1], Steven M. Barlow[1], Don Finan[2], Susan Stumm[1], Shiva Ponnaboyina[1], Raghu Shantha[1]

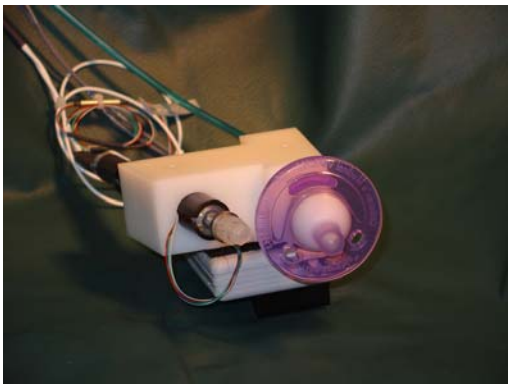
[1]Communication Neuroscience Laboratories
University of Kansas

[2]Department of Speech, Language, & Hearing Sciences
University of Colorado

Time series analysis of cycle period in normal, full-term infants ranging in age from 4 days to 6 months, indicated that qualitatively different behavior patterns are produced for shorter non-nutritive suck (NNS) bursts versus longer bursts (Finan & Barlow, 1998). Longer NNS bursts exhibited lower cycle period variability and became the predominant mode with increased subject age. Cycle period variability decreased with age. Its seems reasonable to propose that the more traditional forms of infant suck analysis (magnitude, frequency, etc) would benefit from the addition of contemporary neurophysiologic methods to reveal patterns of sensorimotor control during the course of non-nutritive suck dynamics. The current report considers the ontogenesis of NNS dynamics in preterm babies using the new ACTIFIER II technology which allows for simultaneous recording and analysis of biomechanical and electrophysiological data during NNS. Cribside recordings of NNS behavior, including intraluminal pressure of the silicone WeeSoothie pacifier coupled to the ACTIFIER II, along with electromyographic recordings from up to 4 muscle sites were completed in a group of preterm and term infants.

Introduction.

Premature birth is associated with a variety of medical and developmental conditions that may disrupt motor skill acquisition. The orofacial anatomy represents a complex muscle system whose early function is integral to nutritive and non-nutritive suck behaviors, and to later emergent activities including vocalization, babbling, and speech. Unfortunately, many neonates in the neonatal intensive care unit (NICU) exhibit disordered patterning of suck, aversive reactions to somatosensory inputs, and subsequently poor feeding ability. Significant questions surround the nature of the links, if any, between pre- and postnatal motor control and those behaviors which speech physiologists have traditionally ascribed as precursors to speech (cooing and babbling).



Selley et al. (1990) recognized that the complexity of sucking, swallowing and breathing underscore the importance of intact sensory mechanisms. Premature and brain-damaged infants' ability to adapt oromotor skills in disorganized, depriving environments is dramatically compromised. To date, quantifiable biomechanical assessment of the preterm neonatal oromotor system is limited to a few reports (Finan & Barlow, 1998; Barlow, Dusick, Finan, Coltart, Biswas, & Denne, 1999; Barlow, Dusick, Finan, Biswas, Coltart, & Flaherty, 2000; Barlow, Dusick, Finan, Coltart, & Biswas, 2001). Thus, the goal of the current report is to detail our continued progress on the dynamics of non-nutritive suck in preterm babies in the neonatal intensive care unit using the new ACTIFIER II technology. A new program was developed in LabView and Matlab known as NEOSUCK. This routine provides for real time multi-channel data acquisition and waveform display of the suck signal (pressure) and 4 channels of EMG in 30-second data blocks. Suck period and suck

amplitude histograms, along with an index of phasic muscle bursting, are generated automatically and ASCII data parameters are dumped to disk files. Improved electrophysiological recordings of facial EMG signals are achieved with new 4 mm diameter Ag/AgCl thick film hydrogel electrode. This sensor was engineered specifically for use in the NICU with the ACTIFIER II system (Barlow & Manoli, 2003). Testing is currently underway at 3 sites, including two NICU's and one follow-up laboratory at the University of Kansas. The present report will include IEMG from circumoral muscle sites and suck dynamics from preterm and term infants through the 1st year of life. Inclusion criteria include normal vital signs, oxygen saturation, and neurologic exam for gestation at the time of testing. Preliminary results indicate that changes in the neurophysiological status of the perioral system are paralleled by changes in suck dynamics, including burst length and complexity, burst amplitude, production frequency, and phasic burst index of EMG. Term infants typically manifest higher frequency of sucking with well defined pause patterns than their preterm counterparts. An analysis of the rhythms of non-nutritive sucking is effective in discriminating between normal infants and infants with a history of perinatal distress (Wolff, 1968). Sensorimotor disturbances have been implicated in babies with oromotor dysfunction. Its seems reasonable to propose that the more traditional forms of infant suck analysis (magnitude, frequency, etc) will continue to benefit from the addition of contemporary neurophysiologic methods to reveal patterns of sensorimotor control during the course of non-nutritive suck dynamics. The results from the current investigation will be used to develop synthetic suck templates for use in future habilitative entrainment studies of the orofacial system in human neonates. (Funded by the National Institutes of Health R01 DC03311-02).

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