KU testing high-tech pacifier in KC, Topeka that may help preemies, boost IQ

LAWRENCE-- Babies who are born prematurely are often in grave danger. They may not be able to suck, swallow or breathe on their own. Some "preemies" suffer strokes or hemorrhage during or shortly after birth. Many more have subtle brain injuries that affect the development of intelligence and speech.

But a new high-tech pacifier being developed by the University of Kansas to train babies to suck at the right time, in the right way, may allow them to feed, thrive and leave intensive care units earlier. The pacifier also may reduce the incidence or severity of certain developmental disabilities that appear in early childhood and beyond as well as possibly boost IQ.

The Actifier, invented by Steven Barlow, KU professor of speech-language-hearing, and Donald Finan of the University of Colorado, becomes an active diagnostic and treatment device once it is plugged into a rolling crib-side laboratory. KU has applied for a patent on the device.

Barlow and his colleagues will be testing it on 390 infants in neonatal intensive care units at Stormont-Vail Regional Health Center in Topeka and the KU Medical Center in Kansas City, Kan. The study will continue for three years. A $2 million National Institutes of Health grant supports basic research and clinical trials of the Actifier to diagnose and correct infants' sucking problems and to explore underlying nerve and brain processes.

For Barlow, director of the Communication Neuroscience Laboratories at KU, the Actifier is the culmination of more than 15 years of collaboration with physicians, engineers and physiologists to produce a technology that would both measure and treat threats to infants' brain development.

"A baby's ability to suck is about more than getting nourishment," Barlow said. "This motor behavior generates sensory flow that nurtures the brain to form and strengthen nerve connections and pathways."

Sucking is a "sensorimotor" skill that normally begins in the womb and is an important stimulus for babies' developing brains. "When babies come too early, we have to figure out ways to augment and supplement those stimulation patterns," Barlow said.

Futhermore, Barlow and others believe that early problems with sensorimotor skills like sucking may influence later brain development, including speech. From the baby's perspective, the Actifier is just a pacifier to latch onto for a few minutes before feeding time. But behind a comforting silicone nipple is an array of specially designed computer-controlled sensors and motors that stimulate and record neuromuscular responses while the baby sucks.

A gently pulsing motor stimulates nerve endings in the soft tissues of the baby's lip that transmit signals to circuits in the brain that coordinate and time muscle contractions.

The Actifier returns information to researchers on how well the brain stem circuits and other parts of the brain are connected. It tells doctors and nurses how the baby is responding when it is sucking, including the organization of its motor system, suck pressure and frequency, and muscle reflexes Ü all in real time on the device's display panel.

The Actifier becomes a rehabilitative device when it gives the baby model suck patterns to imitate through the movement of the nipple. "We can begin therapy with the Actifier as early as two and half months preterm while neural pathways are migrating and forming connections," Barlow said.

He and other neuroscientists believe that by reinforcing such model patterns of nerve activation, new connections in the developing brain are strengthened. Barlow said physicians are particularly excited about the Actifier's potential to help two groups of babies in the study: those with respiratory distress syndrome (RDS) and those who have vascular strokes, or intraventricular hemorrhage (IVH).

Babies with RDS need to learn to suck after they get off ventilators or they may not thrive and develop as expected. Doctors need better functional measures of IVH in babies as well as a way to retrain stroke-damaged brains. By 2007, when the study concludes, Barlow hopes to have diagnostic and treatment guidelines for these babies and other preemies with feeding disorders. "The Actifier should help those babies be more proficient feeders and get their sensorimotor systems organized," he said.

The babies will continue to use the Actifier at regular intervals until their second birthdays. At that time, Barlow will turn them over to John Colombo, a KU professor of psychology who is an expert at testing the intelligence of very young children. If Barlow is right, these children will have higher IQs than their counterparts who were not treated with the Actifier.

Other researchers and personnel involved with the project include Carol Boliek, professor of speech and hearing sciences and pediatrics at the University of Alberta in Canada; Jose Gierbolini, medical director of newborn services at Stormont-Vail Regional Health Center; Perry Clark, assistant professor of neonatology, KUMC; Susan Cannon, clinical instructor in physical therapy in the Developmental Disabilities Center, KUMC; Joy Carlson with Stormont-Vail; Lana Seibel, developmental speech physiologist, KU's Life Span Institute; and Rajesh Vantipalli, computer engineer, Life Span Institute.

KU students helping with the Actifier project are Susan Stumm, Overland Park doctoral student in speech-language-pathology; Meredith Estep; Wichita doctoral student in neuroscience; Mimi Urish, Laramie, Wyo., graduate student in speech-language-pathology; Monique Fees, Grand Junction, Colo., graduate student in speech-language-pathology; and Meredith Poore, Topeka senior in speech-language-hearing.

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