Conveying the Message about Optimal Infant Positions

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ABSTRACT.

The purpose of this study was to determine a convenient communication tool to help educate parents about varying the positions of their new babies. Eighty-eight percent of babies whose parents had received a brochure explaining the importance of early and regularly scheduled "tummy time" were placed in the prone position more than one time a day. Seventeen of 34 babies were started prone before the second week of life. The average Peabody Developmental Motor Scales-2 locomotion score of the babies regularly placed in prone was significantly higher than that of the babies not regularly placed in prone when tested at 6 months and again at 18 months of age.

KEY WORDS. "Back to Sleep" campaign", infant development, plagiocephaly, torticollis, **"**tummy time**"**

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This work was reviewed by the Institutional Review Board of Xavier University and followed the guidelines for protection of humans in research.

BACKGROUND

It is the responsibility of medical and allied health professionals trained in typical development to help parents understand the importance of varying the positions of infants. Public health campaigns have been very effective in changing the sleep position of new babies in America since 1994 (American Academy of Pediatrics [AAP] Task Force on Sleep Position and Sudden Infant Death Syndrome [SIDS], 2000; Pershing, James, Swanson, & Kattwinkel, 2003; Malloy, 1998; Willinger, et al., 1998.) In contrast, recent research and clinical evidence indicate that parents are not well educated on the value of placing the baby on the tummy to play very early in infancy (Mildred, Beard, Dallwitz, & Unwin, 1995.) In this study researchers explored communication tools health care professionals can use to help convey the normalcy and importance of "tummy time" play to new parents. In this study, "tummy time" is defined as prone positioning of an infant when awake and supervised to encourage development of extensor control of the head and neck.

Policy about infant care has changed in the United States since 1994, when the "Back to Sleep" campaign was launched as a joint effort of the American Academy of Pediatrics (AAP), the U.S. Public Health Service, the SIDS Alliance, and the Association of SIDS and Infant Mortality Programs after examination of a variety of studies suggested that "the weight of evidence implicates the prone position as a significant risk factor for SIDS." (Kattwinkel, Brooks & Myerberg, 1992, p.1124.) The purpose of the campaign was to disseminate their suggestion that infants be routinely placed on their backs to sleep to decrease the possibility of SIDS. National and international research has since validated that babies sleeping on their backs have less risk of succumbing to SIDS (Persing, et al, 2003.) The AAP Task Force 2000 report

provided new guidelines to encourage caregivers to monitor the head position of supine sleeping babies and further advocated that "Prone positioning when awake and observed (tummy time) is recommended for development of upper shoulder girdle strength and avoidance of occipital plagiocephaly. These reminders should become a part of routine office anticipatory guidance."(AAP Task Force, 2000, p.653.)

It has been documented in the literature that infants who sleep in prone develop better motor skills in prone that infants who sleep in supine (Dewey, Fleming & Golding,1998; Jantz, Blosser, & Fruechting, 1997: Holt, 1960.) Other studies have suggested that placing an infant in prone to play during the day will help normalize motor milestone acquisition (Davis, Moon, Sachs, & Ottolini, 1998; Salls, Silverman, & Gatty, 2002,) and avoid flat spots on the developing skull (AAP Task Force, 2000; Littlefield, Reiff, & Rekate, 2003; Kane, Mitchell, Craven, & March, 1996; Persing et al., 2003.) Theories of normal development suggest that prone play helps to develop extensor tone and head control against gravity. (Bly, 1994; Kramer & Hinojosa, 1999; Piper & Darrah, 1994.) In spite of these findings parents today seem to be limiting positions used with their infants. In 1995, Mildred et al. found that 26% of the 100 parents interviewed for their study never placed their infant in prone, with a suggestion that this was probably related at least partly to a fear of SIDS (p. 501.)

Davis et al. (1998) suggested that infants who sleep in supine, but regularly play in prone, demonstrate faster acquisition of motor milestones, especially rolling prone to supine, crawling, creeping, and pulling to stand. They also reported that most infants walk independently at a time close to their first birthday whether sleeping prone or supine. Other research supports the conclusion that no significant difference in developmental skills remains at 12 or 18 months of age (Dewey et al., 1998; Sall et al., 2002.) Davis concludes by stating that "it is yet unclear if

there are any long-term developmental effects from sleep positioning… further studies are indicated as this generation of predominantly supine sleepers becomes older." (p.1140)

The currently documented effects of sustained positioning in supine are more pervasive than delayed rolling ability. Researchers agree that while sleeping supine has helped decrease SIDS, an unfortunate concurrent rise in the incidence of positional plagiocephaly associated with supine positioning has occurred (Johns, Jane, & Lin, 2000; Kane et al., 1996; Littlefield et al., 2003; Persing et al., 2003.) Plagiocephaly is defined by Littlefield et al. as an asymmetrical molding of the head caused by external forces. Other terms for this condition found in the literature are deformational plagiocephaly, occipital plagiocephaly, benign positional molding, and plagiocephaly without synostosis (Persing et al., 2003.)

Littlefield et al. (2003) suggest that almost 20% of infants have noticeable flattening of the head and asymmetry of the skull base and face. They state that neck dysfunctions are almost universally found with the plagiocephaly. Most can be treated with repositioning (such as structured "tummy time,") but they further suggest that approximately one in every 65 infants develops a deformity that warrants an aggressive treatment program. This program may include physical therapy for neck stretching, orthotic management with a helmet, and, in very severe cases, cranial surgery. (p.8)

Purpose

The purpose of this study was to determine how the medical community can most effectively educate new parents about the importance of placing an infant in a variety of positions, including prone, when awake and supervised. The researchers tried to determine if adding video information * (Phase I) or a colorful brochure** (Phase II) to the routine information given by the family doctor would influence the choice of play positioning used by

new parents. The videotape and the brochure used in Phase I and II of this study were ways to present information visually to each family in a uniform and consistent manner. Literature from education specialists advocates using a variety of teaching strategies to enhance learning of new information (LaBorde, 1984; Sousa, 1998.)

*The video used was *Amazing Babies: Moving in the first year* produced by Beverly Stokes
** The brochure, *Baby Development Information,* was written by the researchers.

METHODS

Assumptions

The researchers made the following assumptions: (1) All parents would receive verbal instructions about positioning a newborn from their pediatrician. (2) All infants would be placed in supine to sleep. (3) Because of the video or written information presented to the parents, infants would be placed more frequently in prone to play. (4) Infants who slept in supine but played regularly in prone would have more advanced motor milestones (as measured by Peabody Developmental Motor Scales, Second Edition, [PDMS-2] at six months of age) than infants who played primarily in supine. (5) Normal motor milestones in six-month old babies would include the ability to lift and control the head in antigravity flexion and extension.

Subjects and Groups

Parents of 113 infants were recruited and gave consent to have their infants in the study: 62 during Phase I (2001-02) and 51 during Phase II (2002-03). Parents were recruited by the nurses of three pediatric physician groups and one obstetric group in a midwestern suburban county**.** Parents were also recruited by several Early Intervention (EI) nurses making Welcome Home visits**.** Parents of 78 infants complied with the request to bring their baby in for a developmental

screening within one week of the six-month birthday. Table 1 shows the breakdown of study participants for six-month old babies.

Table 1

The ethnic origins of the families, other than Caucasian, were three African-American, one Estonian, and two Hispanic. Socioeconomic levels ranged from single mothers utilizing Supplemental Security Income help to upper middle class, two parent families. Parent educational levels ranged from non-completion of high school to doctoral degree. None of the babies had diagnosed neurological impairment. Babies born prematurely were included in the research. The greatest difference in adjusted age was for a baby born five weeks prematurely. Phase I and Phase II babies were from the same geographic location.

Groups were categorized by type of positioning information received by the parents. Group 1 was considered the control group. These were the parents in the original study design in 2001-02 who only received positioning information in the pediatrician's office. Group 2 were the parents in 2001-02 who watched a developmental video during a Welcome Home nurse visit in addition to receiving information in the pediatrician's office. Group 3 parents received a Welcome Home nurse visit but did not watch the developmental video. During the duplicated study in 2002-03 (Phase II), Group 5 became all the parents recruited in physicians' offices and through Welcome Home Nurses. These parents all received a family friendly informational brochure explaining suggestions for varying a new baby's positions. Data collected during Phase II was compared to data results of Phase I. Table 2 explains the various groups of subjects by recruitment source and type of educational information received.

Table 2

An additional group, Group 4, consisted of the parents of 28 of the originally evaluated 44 babies who agreed to allow a reevaluation at 18 months of age. The 18 month skills of those babies were compared to positioning choices reported on the six-month survey. No difference in gross motor development was expected at 18 months of age.

Procedures

The Institutional Review Board (IRB) for research utilizing human subjects at Xavier University, Cincinnati, Ohio, approved the study design and consent forms prior to recruitment of the subjects for all aspects of the study.

After IRB approval, the researchers gathered baseline information about positioning instructions from the referral sources via surveys. The supine position for sleep was consistently presented by pediatricians and all nurses. The surveys seemed to indicate, however, that positioning information about "tummy time" was not presented in a standard format. Physicians reported that they did not always discuss prone playtime with new parents. Some physicians recommended 15 minutes a day; others suggested 45 minutes a day. .Most of the Early Intervention nurses distributed the SIDS Alliance brochure that commented on positioning for sleep and play and encouraged some tummy time each day. The obstetric nurses commented that prior to joining the study, information given to parents about positioning was minimal. No professionals from any of the groups offered suggestions to parents to help babies become accustomed to "tummy time" or to help when babies would not tolerate the "tummy time" recommended.

The medical personnel recruiting babies for the study agreed to ask all new parents to participate during the months of July, August, and September of 2001 for Phase I and September, October, and November of 2002 for Phase II. The 62 parents in Phase I and 51 parents in Phase

II who were willing to participate determined the sample. All study consent forms gathered from these referral sources were forwarded to the researchers. The first contact that the researchers had with the parents was by phone at five months to set an appointment to assess the motor skills of the infants at six months of age.

Evaluation Procedure

All babies were assessed individually within one week of their actual six month birthdays in a standard setting (a physical therapy clinic), unless it was difficult for the parents to travel. In those cases, the team evaluated the babies in their homes. The evaluations were completed in one session for all babies except two. Due to extreme fussiness, those babies were rescheduled and the evaluations completed on another day.

Phase I babies were assessed with only the gross motor subtests of the PDMS-2. Phase II six-month babies and the 18 month toddlers were assessed using both gross and fine motor subtests. During all assessments, the parents completed a survey designed to determine the regularity of placing the baby to sleep in supine and in prone to play. Data about positioning choices from the surveys were used to compare the effect of the educational information on the choices made by the parents. In Phase II, the date listed on the consent form was used as an indication of how early the parents received the brochure information. Parents were also asked in the survey when they actually started to place the babies in prone during playtime.

Following a mandate from the IRB that recommendations should be given to families if deficits were noted, personalized play activities were demonstrated for all parents and recommendations for positioning and moving toward the next step in development were provided verbally during each screening. The researchers developed a follow-up report to send

to parents and to the family physician summarizing the results of the PDMS-2, and restating the recommendations that had been demonstrated.

Equipment

Evaluation Instrument

The research team used the Peabody Developmental Motor Scales-Second Edition to assess all babies that completed the project. The PDMS-2 was chosen because it has separate, independently standardized gross motor and fine motor sections and was developed for use in research. (Folio & Fewell, 2000.) It had recently been re-standardized (2000) and was familiar to the researchers. The testing materials remained the same to allow comparison between Phase I babies and Phase II babies.

The team did not utilize the normative data analysis as suggested in the test manual. The test manual method converted subtest raw scores to percentiles and standard scores based on the month of age only, while dropping all additional days. Thus data from babies only a few days different in age, *i.e*. 6-months versus 5 months 29 days, would have been compared to different standard scores. For consistency, the team compared the sum of the gross motor scores without conversion.

The test manual suggested adjustment for days of prematurity, but did not consider any days beyond the due date. For consistency, the team compared babies using an "adjusted age" that considered all days. Exact age was the testing date minus the birth date. The adjusted age was the exact age + /- days between due date and birth date. The range of the adjusted ages was 146 days for the youngest baby to 202 days for the oldest. These changes were assumed to improve sensitivity of the test as it more accurately reflected the performance differences of the various babies who were all chronologically close to six months old (plus or minus ten days.)

In the test manual, determining the sum for the gross motor sections added the raw scores for the Reflex section, Stationary section, and the Locomotion section. The team analyzed the sum for the gross motor sections with the positioning choices of the parents, but found that the Locomotion section alone showed the significant relationships that are reported under Results. The team was primarily interested in developmental skills related to time spent in the prone position such as head control, reaching while prone on elbows, rolling, moving forward, and assuming an all fours position. The Locomotion section items best reflected those skills.

The Statistical Software Program

The statistical software program, SAS, was chosen to evaluate the data. It is well respected in industry and regulatory agencies. It is the most widely used package for and designed to integrate and analyze clinical information. Table 3 shows the 2002 and 2003 bridged survey responses and how the data was combined in the statistics.

Table 3

The Videotape

The videotape used in this study was *Amazing Babies: Moving in the First Year* produced by Beverly Stokes. The portion shown to the mothers included video images of babies from one to four months of age playing in prone and supine.

The Brochure

The *Baby Development Information* brochure was authored by the primary researchers to be an expedient visual means of communicating optimum positioning choices to parents. It was reviewed by the nurses in the pediatric offices and the Early Intervention Director before being used in Phase II. It was designed in family friendly language to explain the rationale for varying positions, to suggest a schedule for daily prone play, and to provide helpful hints on inclining a

baby in prone placement when babies were not tolerant of the position. The time when the brochure was given to parents varied from pre-delivery to two months of age. The date was recorded on the consent form by the recruiter before sending the form to the researchers.

RESULTS

The central theme for the study was to determine the most effective way to communicate to parents the optimal positioning for infants. Using the motor performance scores to determine the effectiveness of the education became a two step process. The first step was to determine how the verbal, video, and/or brochure communication to parents affected the parent positioning choices. The second step required comparing the regularity of the positioning choices with the resultant motor skill development of the babies.

With the data analysis, three models of significant relationships surfaced. The first compared how the parents received positioning information (doctors, nurses, video, and/or brochure) with the answers received on the parent survey describing the positioning choices for play during awake times. The second compared the adjusted ages of the babies and the positioning choices for play in prone as co-variables with gross motor development as measured by the PDMS-2 locomotion scores. The third compared the positioning choices for play in prone prior to six months of age with gross motor development at 18 months of age using PDMS-2 scores.

In the model comparing the source of the information to new parents with the parents' choice of placement in prone for play, a significant pattern emerged ($P = .0001$). The pattern showed that the percentage of prone placement increased with the addition of Welcome Home nurse visits and peaked with the addition of written information to parents in the form of the

brochure. The effect of the nurse visit was not significantly enhanced by showing a developmental videotape. Table 4 shows this pattern.

Table 4

Before comparing the placement choices and the gross motor performance, the effect of prematurity had to be determined. The analysis showed that exact age (date of evaluation – date of birth) correlated with PDMS-2 Locomotion scores was not significant (P= .073). Using adjusted age (exact age +/- days between due date and birth date) correlated with Locomotion scores was significant (P= .0013). Adjusted age became a co-variable with the positioning choices when analyzing the effect on the gross motor performance.

In the second model, co-variables of adjusted age and positioning choice were compared with the gross motor performance as determined by the PDMS-2 Locomotion scores. Significant relationships only surfaced in the youngest adjusted age group of babies. Babies in this youngest group placed in prone more than once a day had an average locomotion score significantly higher than other babies in the youngest group who were seldom placed in prone (P=.0012) or placed in prone less than once a day (P=.0010). Also significant was the average locomotion score of these youngest babies placed in prone only once a day compared to the babies seldom in prone (P=.0367). The full comparison chart for gross motor performance is displayed in Table 5.

Table 5

Most of the 2002-03 Phase II babies were placed in prone early: 17 of the 33 babies within the first week after birth. In contrast, the 2001-02 Phase I babies, if placed in prone at all, tended to be placed in prone only after being seen by a Welcome Home nurse or the second visit with the doctor at approximately one month of age.

In model three, the longitudinal part of the study, data indicated that significant gross motor differences did exist for the 18-month old babies dependent on the amount of time spent in prone for play before six months of age. The PDMS-2 Locomotion scores ranged between 79 and 90 for the 18-month old babies. For this comparison, the average Locomotion score from all babies who were placed routinely in prone to play more than one time a day before the age of six months (84.9) was compared to the average Locomotion score from all babies not placed routinely in prone to play (82.1). This was significant. (P=.015)

Table 6

DISCUSSION

In the 30 months developing this research, a positive trend has been noted. Some of the Phase I babies had very limited development, poor antigravity head control in flexion or supine, and presented with flat spots on the head. One was being seen in a physical therapy clinic for torticollis. Few parents in Phase I remarked about being comfortable placing their child in prone; in fact, some parents actually stated that they feared SIDS if they ever placed the baby on the tummy.

In contrast, all of the Phase II parents who read the brochure (only one stated that she never received the brochure) were more relaxed about placing the baby in prone on a daily basis. Very

few of the Phase II babies had flat spots on the head. In addition to the study sources, parents cited hearing about the "tummy time" concept of prone placement for play from friends, family or magazines.

It became apparent during Phase I, that the parents were getting positioning information too late. Parents in Phase I were generally not being told to place the babies in prone until the Welcome Home nurses visited (at 2-4 weeks after birth) or the one month well baby check-up. Many of these parents reported to us that when they initiated "tummy time" at that time, the baby would not tolerate the position and the parents therefore quit trying. In Phase II an earnest effort was made to get information to parents as close to the date of birth as possible. Four mothers received the brochure pre-delivery in the Obstetric packet. Staff in the pediatric offices handed the brochure to parents at the one week visit. In Phase II, 17 of 34 babies were reportedly started on "tummy time" within the first week. Another six were placed prone regularly before the one-month check up.

The need for uniform information was also apparent from the inception of this project. No consistent information about "tummy time" was presented by professionals in this study. Nurses stated that parents received instructions to place a baby in prone from "5-10 minutes a day" to "as much time as possible." Parents consistently reported that the nurses emphasized "tummy time".

Written information provided several benefits. It provided a unified formula to help parents establish a routine of tummy time: one to two minutes after each diaper change or nap, increasing the amount as the baby grew and became stronger. Many parents in Phase II reported a schedule for tummy time daily. The written information also offered answers to questions parents had about varying positions: how to avoid flat spots on the head, when to use equipment,

and why sleeping on the back was important. The suggestion to incline the baby in prone with a small rolled towel under a baby's chest may have increased tolerance of the prone position.

The 18-month significant statistical difference in motor skills was not seen elsewhere in the literature, therefore no significant differences were expected. Clinically all babies were walking and scored within normal limits on the full PDMS-2 test. Further research is recommended to test the authenticity of these 18 month findings.

And lastly, a new positioning dilemma surfaced: "flat head backlash". One parent forbade anyone placing her second child, our study participant, on his back because she was convinced that the first son had a flat head because of "backlying" As expected, this baby lacked sitting balance, tummy strength, and righting reflexes usually acquired from supine play.

Limitation*s*

Sample size and demographics were limited to babies referred to the team by the participating doctors and nurses. All babies were from the same geographic location, in a suburban Midwestern area. Minority groups were not excluded, but were not represented as well as they might have been in a different setting.

During the screening process, one of the evaluators had a cursory knowledge of which group each baby was in because the calling and paper work organization was done by this investigator. This was compensated for by having the other evaluator blind to each baby's group before the evaluation. A second attempt was made to limit the effect of knowledge of group by assembling the call list by birthdates, not by group. Babies from all three sources of information groups could be seen on the same day.

Fully accurate parent recall of early positioning choices was not possible. No interim verification system was used during the six months prior to the evaluation. This was deliberate to

avoid prejudicing the parents' choices prior to the evaluations. As four occupational therapy students assisted with data gathering in Phase I, six interviewers gathered information from the parents, which increased the variability in interpretation of the parents' answers. Only the primary researchers gathered information on the Phase II surveys.

Regardless of the type of positioning education received during the study, parents made the ultimate decisions about care and positioning of their child. Some parents reported that they chose to carry their baby most of the time.

Influences outside of the research focus could not be limited. Doctors were not resurveyed in 2003 to determine changes in their directives regarding time in prone. Parents in Phase I were not asked on the survey about other sources of information about "tummy time" play. That question was asked in the second survey. Parents in Phase II had reportedly received information about positioning from sources other than the doctors and nurses, or the brochure in this study. Family, friends, and magazines were sources marked on some surveys. This limits the ability to fully determine exactly what impact the brochure had on positioning choices. This study does not prove that the relationship between the receipt of the brochure and the placement on the tummy are directly related. The committee was confident from the data and the comments by the parents that the parents' choice of placement on the tummy and receipt of the brochure were indeed correlated.

Importance of this study

This research helps to build the body of knowledge about baby development and optimum education techniques that medical professionals can use to help new parents choose optimum positioning strategies for their new infants. The plagiocephaly and torticollis problems seen in

many babies due to static supine positioning can be greatly eliminated with early written instructions about the value of "tummy time" when a baby is awake and supervised.

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Table 1

Study Participants				
	Recruited	**Evaluated**	**Boys**	**Girls**
Phase I, 2002 Video	62	44	20	24
Phase II, 2002 Brochure	51	34	21	13
Total Babies in Study	113	78	41	37

Table 2

Groups of Subjects Determined by Recruitment Sources and Education Methods

Original Phase I Study with Video Showing				
Phase I, 2002	Doctor Directives	Welcome Home Nurse with Video	Welcome Home Nurse, no video	**Total Babies**
	Group 1	**Group 2**	**Group 3**	
Total Recruited	27	35		62
Total Evaluated	23 (13)	21	(10)	44
Follow-Up on Phase I Babies				
Spring, 2003 Follow-up of 18-month old babies	Doctor Directives	Welcome Home Nurse with Video	Welcome Home Nurse, no video	**Total Babies**
	Group 4	**Group4**	**Group 4**	
Total Evaluated	23 (13)	21	(10)	44
Total Re-evaluated	8	15	5	28
Brochures Distributed to New Parents				
Phase II, 2003	Pediatric Offices	Welcome Home Nurses	Obstetric Office	Total
	Group 5	**Group5**	**Group 5**	
Total Recruited	42	5	4	51
Total Evaluated	29	1	4	34

Table 3

2002 and 2003 Bridging of Survey Responses		
Placed in Prone When Awake		
2002	2003	Compared in Data
Seldom		Not routinely
Sometimes	Less than once a day	Not routinely
Frequently	Once a day	Not routinely
Routinely	More than once a day	Routinely

Table 4

Pattern of Increased Prone Play Positioning When a Nurse Visit, Video Showing, and Use of the Brochure Were Added to Physician Information

Source of Information	**Placement Choice For Prone Play**		
	Not Routinely	Routinely > 1x day	Total Babies
Doctor Directives	11 babies 84.62%	2 babies 15.38%	13
Doctor + Nurse Visit	6 60%	4 40%	10
Doctor + Nurse Visit Video Showing	14 66.67%	7 33.33%	21
Doctor + Nurse + Brochure	4 12.12%	29 87.88%	33

Table 5

Effect of Placement for Play and Adjusted Age on Average PDMS-2 Locomotion Score					
Total Number of babies 77			Range of locomotion scores was 11-39.		
Adjusted age in days	**Placement in Prone for Play**				
	Seldom	Sometimes < 1 x day	Frequently 1 x day	Routinely > 1 x day	Total Babies
Less than 174 days > one week premature	3 babies 16.7 average score	5 babies 21.8	3 babies 26 average score	7 babies 30.4 average score	18
174 to 181 days Approx. one week early	3 22	3 28.3	2 23	14 27.5	22
182 to 186, full term		2 29.5	9 27.7	8 26.3	19
187 or older		2 32	3 29.7	13 29.7	18