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Massage Therapy for Infants of Depressed Mothers

TIFFANY FIELD, NANCY GRIZZLE, FRANK SCAFIDI, SONYA ABRAMS, AND SARAH RICHARDSON
University of Miami School of Medicine
CYNTHIA KUHN AND SAUL SCHANBERG
Duke University Medical School

Forty full-term 1- to 3-month-old infants born to depressed adolescent mothers who were low socioeconomic status (SES) and single parents were given 15 min of either massage (n = 20) or rocking for 2 days per week for a 6-week period. The infants who experienced massage therapy compared to infants in the rocking control group spent more time in active alert and active awake states, cried less, and had lower salivary cortisol levels, suggesting lower stress. After the massage versus the rocking sessions, the infants spent less time in an active awake state, suggesting that massage may be more effective than rocking for inducing sleep. Over the 6-week period, the massage-therapy infants gained more weight, showed greater improvement on emotionality, sociability, and soothability temperament dimensions and had greater decreases in urinary stress catecholamines/hormones (norepinephrine, epinephrine, cortisol).

massage therapy depressed mothers infants rocking

Tactile/kinesthetic stimulation, also called massage therapy, facilitates the growth and development of healthy preterm infants. Ottenbacher et al. (1987) conducted a meta-analysis of 19 stimulation studies on preterm infants. They estimated that 72% of the infants who received tactile stimulation showed greater weight gain and development relative to control groups who received standard treatment but no additional tactile stimulation.

In one of the meta-analysis studies, several positive effects were noted for preterm infants (Field et al., 1986) including a 47% greater weight gain per day (even though the groups did not differ on average caloric intake). In addition, the massaged infants were awake and active a greater percentage of the observation time, showed more mature habituation, orientation, motor activity, and range of state behavior on the Brazelton (1973) exam, and were hospitalized 6 days less than the control group infants who did not receive the extra tactile stimulation, yielding an average hospital cost savings of $3,000 per infant (Field et al., 1986). In a subsequent replication study (Scafidi et al., 1990), the stimulated infants averaged a 21% greater weight gain per day, were discharged 5 days earlier, showed superior performance on the habituation cluster of the Brazelton, and showed more mature sleep organization (i.e., less indeterminate sleep, which is considered a less mature sleep state). This finding was particularly interesting inasmuch as indeterminate sleep has been noted to be inversely related to IQ scores obtained 12 years later (Sigman & Parmelee, 1989).

The mechanism underlying the stimulation–weight gain relationship has not yet been determined, but a possible explanation relates to the finding that stimulation increases vagal activity which in turn releases food absorption hormones. Intraoral stimulation during sucking, for example, facilitates the release of food absorption hormones such as insulin and glucose (Uvnas-Moberg, Widstrom, Marchini, & Winberg, 1987). Preliminary data from our lab suggest that vagal activity is greater and insulin levels are higher in preterm infants following tactile stimulation (Scafidi et al., in press). Not only is increased vagal activity associated with a parasympathetic state in which heart rate is lower and attentiveness is greater (Porges, 1985), but the vagus is also noted to facilitate the release of food absorption hormones in the gastrointestinal tract (Uvnas-Moberg et al., 1987).

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Correspondence and requests for reprints should be sent to Tiffany Field, Touch Research Institute, University of Miami School of Medicine, P.O. Box 016820, Miami, FL 33101.

Although massage-therapy benefits have been documented for high-risk preterm infants, the benefits of massage for full-term infants have not been explored. Even older full-term infants might benefit, and particularly full-term infants born to high-risk mothers such as depressed mothers. Several studies have documented less positive affect in infants of depressed mothers (Cohn, Matias, Tronick, Connell & Lyons-Ruth, 1986; Field, 1984); and more recently, growth delays and inferior performance on developmental assessments have been noted in infants of depressed mothers (Field, 1992). Massaging these infants might improve their affect and growth, as it did with preterm infants (Field et al., 1986).

We conducted this study to evaluate the potential benefits of massage therapy for healthy infants who were born to depressed mothers. Based upon our earlier research with preterm infants (Field et al., 1986; Scafidi et al., 1990), we expected to find that massaging full-term healthy infants would have the following effects: (a) greater daily weight gain; (b) more organized sleep/wake behaviors; (c) less fussiness and more positive affect; and (d) lower cortisol and norepinephrine levels.

METHOD

Subjects

The sample was comprised of 40 full-term 1- to 3-month-old infants born to depressed adolescent mothers. The infants were recruited at birth and attended our daycare nursery from birth and during the time they participated in the study. The infants were born full-term (*M* gestational age = 39.4 weeks, range = 37–41), were normal birthweight (*M* = 3,483 gms, range = 3120–3610), and had normal Apgar scores (*M* = 9.1, range = 6–10; see Table 1). Their mothers were categorized as low SES (*M* = 4.2 range = 3.1–5.0) on the Hollingshead Index (Yale University, New Haven, CT), were single parents, were adolescents (*M* age = 17.3 years range = 14–19) and were primary caregivers on public assistance; 65% were African American, 35% were Hispanic. The infants were randomly assigned to a massage-therapy group or a rocking control group. The two groups did not differ on any of the maternal demographic characteristics based on chi-square analyses of their ethnic distribution and *t* tests of their SES. In addition, the groups did not differ on infant birth characteristics based on *t* tests or on sex distribution based on chi-square analyses.

The mothers were classified depressed because they were diagnosed dysthymic on the Diagnostic Interview Schedule (DIS; Costello, Edelbrock, & Costello, 1985) and had Beck Depression Inventory (Beck, Ward, Mendelson, Mach, & Erbaugh, 1961) scores greater than 16 (*M* = 28.1).

Diagnostic Interview Schedule (DIS). The DIS is a standardized diagnostic interview that addresses specific symptoms as well as their chronology, duration, and associated impairments. The interview has a step structure that minimizes interviewing time. The questions are precoded 0–1–2, corresponding to "no," "somewhat or sometimes," and "yes." Reliability and validity of the DIS have been found to be as good or better than other structured diagnostic interviews (Costello et al., 1985). The interviews for this study were conducted by one interviewer who had received training at a national DIS training workshop. For this study, only the Affective Disorder Module was used to assess depression.

The initial diagnosis was made following the infant's delivery. Another diagnosis was made at the beginning of the study. If a mother was no longer diagnosed depressed, she was not recruited for the study. Only 4% of the mothers were no longer depressed by the time of the study.

During the study, the infants were cared for during the day by teachers at our nursery school. The infants were bottle-fed by nursery caregivers except when the mothers visited. The mothers routinely touched, held, and fed their

TABLE 1
Demographic and Birth Characteristics

	Group		
	Massage Therapy	**Rocking**	***p***
Demographic Variables			
Ethnicity			
Black (%)[a]	66	64	*ns*
Hispanic (%)[a]	34	36	*ns*
SES[b]	4.1 (1.3)	4.3 (1.5)	*ns*
Birth Characteristics[b]			
Gestational Age	39.2 (2.2)	39.6 (2.1)	*ns*
Birthweight	3,477.1 (123.2)	3,489.2 (116.0)	*ns*
Apgar Score	9.0 (1.1)	9.1 (1.2)	*ns*

Note. Standard deviations are in parentheses.
[a]Chi-square analyses were used for group comparisons on this variable.
[b]*t* tests were performed to compare groups on this variable.

infants, which was recorded (presence/absence of each of the behaviors) by the teachers on a daily basis. Based on the teachers' daily record of the amount of time the mothers visited, touched, held, and fed their infants, there were no significant differences between the two groups. In addition, the mothers were unaware of which therapy their infants were receiving (massage or rocking) and were unaware of the intent of the study, as were the teachers.

Procedures

Massage Therapy. The massage-therapy infants (n = 20) were provided a 15-min massage midway between morning feedings 2 days per week for a 6-week period. The infant was placed in a supine position on a comfortable mat in a quiet area of the nursery. The massage therapy was administered by a researcher who was trained on the procedure. The therapist placed a small amount of mineral baby oil on the palms of her warm hands and placed her hands on the infant's chest. She then worked on the following six regions of the infant's body:

1. *Face*: (a) firm strokes with the flats of the fingers along both sides of the face and across the forehead; (b) circular strokes over the temples and the hinge of the jaw; and (c) gentle strokes with the flats of the fingers over the nose, cheeks, jaw, and chin.
2. *Chest*: (a) strokes along both sides of the chest with the flats of the fingers, going from the middle outward; (b) cross strokes from the center of the chest and over the shoulders; and (c) strokes on both sides of the chest simultaneously with flats of the hands over the chest to the shoulders.
3. *Stomach*: (a) hand-over-hand motion in a paddlewheel fashion going from higher to lower region; and (b) circular motion with fingers in a clockwise direction starting at appendix.
4. *Legs/Feet*: (a) long strokes from hip to foot; (b) squeezing and twisting in a wringing motion from foot to hip; (c) long milking strokes toward the heart from foot to hip; and (d) long strokes toward the heart from foot to hip.
5. *Arms*: (a) long strokes from shoulder to hand; (b) squeezing and twisting in a wringing motion from hand to shoulder; (c) long milking strokes toward the heart from hand to shoulder; and (d) long strokes toward the heart from hand to shoulder.
6. *Back* (the infant was placed in a prone position): (a) hand-over-hand motion in a paddlewheel fashion from upper back to buttocks with flats of the hands contoured to the shape of the back; (b) hands from side to side across back including sides; (c) circular motion with fingertips, from head to buttocks over the long muscles next to the spine (not directly rubbing the spine); (d) simultaneous strokes over both sides of the back from the middle to the sides; (e) with finger tips rub and knead the shoulder muscles; (f) with finger tips rub the neck; (g) strokes along length of the back; and (h) strokes from the head to the feet.

Rocking Group. Rocking was used both as an attention (one-on-one) control and a physical contact control for the massage therapy. It was also used as a relatively conservative test for massage-therapy effects inasmuch as rocking itself reduces fussiness and induces sleep, effects we also expected for the massage therapy. The rocking group (n = 20 infants) was scheduled for rocking sessions at the same time of day as the massage group (midway between morning feedings) for the same period of time (15 min 2 days per week over 6 weeks for 12 sessions). During this condition, the infant was held in a cradled position by the researcher and rocked in a rocking chair. This control condition was employed to ensure that any changes noted in behavior/physiology were not related simply to changes in activity or to the physical presence/attention provided by the researcher.

Immediate Effects Measures (During and After Treatment Sessions on First and Last Days)

Sleep/wake Behavior. To determine the immediate effects of the therapies on sleep/wake behavior, the infants were observed by a researcher during and for 15 min after the massage and rocking sessions on the first and last days of the study period. The observer recorded the infant's predominant state and various behaviors using a time-sampling unit methodology with 10-s recording intervals. An adaptation of Thoman's (Thoman, Denenberg, Sievel, Zeidner, & Becker, 1981) system of sleep recording was used. The sleep state criteria were as follows: (a) quiet sleep (no REM)—the infant's eyes are closed and still, and there is no motor activity other than an occasional startle, rhythmic mouthing, or a slight limb movement; (b) active sleep (without REM)—the infant's eyes are closed and still, motor activity is present; (c) REM sleep—the infant's eyes are closed, although they may open briefly, rapid eye movements can be detected through closed eyelids, and motor activity may or may not be present; (d) drowsy—the infant's eyes may be opening and closing but have a dull, glazed appearance, motor activity is minimal; (e) inactive alert—the infant is relatively inactive, although there may be occasional limb movements, the eyes are wide open and bright and shiny; (f) active awake—the infant's eyes are open and there is motor activity; and (g) crying—the infant's eyes can be open or closed, and motor activity is present as are agitated vocalizations. In addition to coding behavioral states, the observer also recorded (a) single-limb movements, (b) multiple-limb movements, (c) gross body movements, (d) head-turning, (e) facial grimaces, (f) startles, (g) mouthing, (h) smiles, and (i) clenched fists.

Total time-sample units were converted to percentage of observation time that different states and behaviors occurred for the purposes of data analyses. To ensure reliability of the coding, the observer was first trained to a criterion of 90% reliability (N agreements/N agreements plus disagreements) prior to the onset of the study. Interobserver reliability was then determined during the course of the study by the simultaneous observation and coding of 10 randomly selected sleep observations which were videotaped. The coding was done simultaneously to ensure that the start and end points were synchronized. The coders used laptop computers and were separated by a post so they could not observe each other's coding. The reliability coefficients were calculated by dividing the number of agreements (same behaviors coded for a given time-sampling unit by both observers) by the number of agreements and disagreements. The reliability coefficients averaged .84.

Salivary Cortisol. Saliva samples were obtained immediately before and 20 min after the massage and rocking ses-

sions (held between the morning feeding sessions on the first and last days of the study). They were assayed to determine any changes in cortisol levels as a general index of stress. Due to the 20-min lag between plasma and salivary cortisol levels, saliva samples reflected stress states at 20 min prior to the session and immediately following the session. The saliva samples were frozen and later assayed for cortisol levels at Duke University

Longer Term Measures (First Day/Last Day)

Weight and Formula Intake Data. Volume of daytime formula intake was recorded daily by the infant caregivers. The mothers also recorded the number of nighttime bottle feedings. In addition, the infants were weighed daily immediately prior to the early morning feeding.

Temperament Ratings. On the first and last days of the treatment period, the Colorado Child Temperament Inventory (CCTI; Rowe & Plomin, 1977) was completed by the infants' nursery school teachers who are masters degree teachers and who received reliability training to the .90 level on the CCTI. Interrater reliability between teachers and psychology graduate students based on 30% of the sample yielded kappa coefficients ranging from .73 to .87 (M = .82). This scale is comprised of 30 Likert-type (*strongly disagree* to *strongly agree*) statements such as "Infant tends to be shy" and "Infant is always on the go." This scale yielded six factors, the same in this sample as in the normative sample (Rowe & Plomin, 1977): emotionality, activity, sociability, soothability, persistence, and food adaptation. Test–retest reliability is good, r = .89, and validity has been assessed in relation to interaction ratings made by independent observers which yielded high correlations ranging from .83 to .91 (Field, 1992).

Urine Assays. First morning urine samples were collected on the first and last days of the study. The urine samples were frozen and sent to Duke University for assays. Urine assays of norepinephrine, epinephrine, and serotonin (5H1AA) were conducted by high-pressure liquid chromatography with electrochemical detection; cortisol was determined by radioimmune assay; and creatinine was assayed colorimetrically (Kuhn et al., 1991).

RESULTS

Multivariate repeated-measures analyses of variance were conducted on the immediate effects measures taken during and after the sessions, including sleep/wake behaviors and saliva cortisol, as well as the longer term measures taken on the first and last days of the study, including weight gain, formula intake, temperament ratings, and biochemical variables (urine catecholamines and cortisol). Group comparisons were performed by multivariate and univariate repeated-measures analyses of variance with the assessments made during and after the massage and the assessments made on the first and last days of the study as the repeated measures. Post hoc Bonferroni t tests were performed on interaction effects.

As can be seen in Table 2, the massage-therapy infants were in a different state during the sessions than the rocking group. The massage-therapy infants spent more time in inactive alert and active awake states (also moving more) and less time in drowsy and quiet sleep states. In addition, their crying and salivary cortisol levels decreased, unlike the rocking group infants whose crying and cortisol levels remained the same. Although the rocking infants spent less time in an active awake state during the rocking session, the massage-therapy infants spent less time in an active awake state following the massage-therapy session, suggesting that massage may be more effective than rocking for inducing sleep.

As can be seen in Table 3, several long-term differences were noted for the massage group infants across the course of the study as opposed to the rocking group infants who did not change. The massage-therapy infants (a) gained weight, although no change occurred in formula intake; (b) improved on temperament dimensions including emotionality, sociability, and soothability; and (c) experienced decreases in urinary catecholamine and cortisol levels and increased serotonin levels.

DISCUSSION

The greater alertness the infants experienced during massage therapy is consistent with data on adults showing EEG changes that conform to a pattern of alertness, namely decreased alpha and increased beta waves. Improved performance on math tasks (less time required and fewer errors) accompanied the EEG pattern of alertness in the same adults receiving massage. The increased alertness data are also consistent with increased attentiveness accompanying increased vagal activity during massage therapy (Field & Schanberg, 1990).

Rocking, in contrast, contributed to drowsiness and quiet sleep states during the rocking, but the greater arousal after the rocking was consistent with anecdotal reports from parents that rocking cessation often awakens the infant. These data combined with the decreases noted in crying and salivary cortisol levels of the massaged versus the rocked infants suggest that massage may be more effective than rocking for inducing sleep.

TABLE 2
Means (and *SDs*) for Sleep/Wake Behaviors During and After Sessions for Massage-Therapy and Rocking Groups[a]

	Massage Therapy		Rocking		
Variables	**During**	**After**	**During**	**After**	***p***
Sleep/Wake Behaviors					
Quiet Sleep	4.3 (2.0)$_a$	48.1 (26.0)$_b$	45.9 (21.0)$_b$	41.8 (18.0)$_b$	.001
Active Sleep	0.0 (0.0)$_a$	4.8 (2.0)$_a$	0.0 (0.0)$_a$	0.0 (0.0)$_a$	*ns*
Rem Sleep	0.0 (0.0)$_a$	2.9 (2.0)$_a$	3.1 (2.0)$_a$	0.0 (0.0)$_a$	*ns*
Drowsy	0.8 (0.0)$_a$	5.3 (3.0)$_b$	4.3 (3.0)$_b$	7.3 (4.0)$_b$	.05
Inactive Alert	35.6 (16.0)$_a$	23.6 (14.0)$_b$	16.7 (11.0)$_{bc}$	10.9 (6.0)$_c$	.05
Active Awake	46.2 (26.0)$_a$	14.3 (9.0)$_b$	21.7 (11.0)$_c$	29.3 (14.0)$_c$	.001
Crying	14.4 (12.0)$_a$	2.5 (2.0)$_b$	8.3 (6.0)$_a$	10.7 (9.0)$_a$	.001
Movement	87.7 (39.0)$_a$	44.1 (21.0)$_b$	45.3 (23.0)$_b$	56.7 (27.0)$_b$	.001
Saliva Cortisol[b]	2.1 (1.0)$_a$	1.4 (1.0)$_b$	1.9 (1.0)$_{ab}$	1.6 (1.0)$_b$	.05

[a]Different letter subscripts denote significant differences.
[b]Saliva cortisol values taken before and after session.

TABLE 3
Means (and *SDs*) for Variables Measured at Beginning and End of Study Period for Massage-Therapy and Rocking Group Infants[a]

	Massage Therapy		Rocking		
Variables	**Day 1**	**Day 12**	**Day 1**	**Day 12**	***p***
Weight (lb)	14.7 (3.0)$_a$	16.3 (3.0)$_b$	14.9 (3.0)$_a$	15.4 (3.0)$_a$	.001
Formula Intake	7.0 (3.0)$_a$	8.4 (3.0)$_a$	8.0 (3.0)$_a$	10.8 (4.0)$_a$	ns
Temperament					
Emotionality[b]	13.7 (3.0)$_a$	12.2 (4.0)$_b$	13.6 (5.0)$_a$	13.0 (5.0)$_a$	.05
Activity	17.9 (6.0)$_a$	17.6 (4.0)$_a$	16.4 (4.0)$_a$	16.0 (5.0)$_a$	ns
Sociability[c]	18.5 (3.0)$_a$	19.9 (4.0)$_b$	19.1 (5.0)$_b$	18.4 (4.0)$_a$	.05
Soothability[c]	16.5 (4.0)$_a$	18.5 (4.0)$_b$	15.8 (5.0)$_a$	15.6 (5.0)$_a$	.05
Persistence	16.5 (3.0)$_a$	16.7 (4.0)$_a$	16.1 (4.0)$_a$	16.8 (4.0)$_a$	ns
Food Adaptation	14.1 (4.0)$_a$	13.4 (4.0)$_a$	14.1 (6.0)$_a$	13.9 (4.0)$_a$	ns
Biochemical Measures[d]					
Norepinephrine[b]	245.3 (139.0)$_a$	119.7 (77.0)$_b$	195.0 (94.0)$_a$	180.0 (89.0)$_a$	.05
Epinephrine[b]	21.5 (14.0)$_a$	10.6 (6.0)$_b$	16.0 (10.0)$_a$	23.6 (15.0)$_a$	.05
Serotonin (5H1AA)[c]	944.9 (581.0)$_a$	1427.9 (779.0)$_b$	1001.5 (492.0)$_a$	1132.4 (517.0)$_a$	.05
Cortisol (urine)[b]	1382.9 (717.0)$_a$	656.4 (340.0)$_b$	1225.4 (639.0)$_a$	1016.8 (523.0)$_a$	.05

[a]Different letter subscripts denote significant differences.
[b]Lower value is optimal.
[c]Higher value is optimal.
[d]Biochemical measures expressed as ng/gm creatinine.

The longer term gains made by the massaged versus the rocked infants are perhaps more surprising. Although several studies have reported that preterm infants gained more weight following massage (Field et al., 1986; Ottenbacher et al., 1987; Scafidi et al., 1990), the baseline weights of the full-term infants in this study were higher. Thus, the massage might not be expected to increase their weight. They did, however, show greater weight gain, even though a difference of 1.1 lb might not be considered clinically significant. Nonetheless, the data suggest that because infants of chronically depressed mothers are noted to show growth delays by 1 year (Field, 1992) and because massage is an easy technique for mothers to learn, this may be an effective measure for sustaining weight gain.

Improved ratings on emotionality and sociability temperament dimensions suggest that the massage enhanced the infants' responsivity to social stimulation. Increased soothability and decreased stress levels, as suggested by lower cortisol and catecholamine levels, may have also contributed to the infants' enhanced responsivity.

In summary, these data suggest that massage therapy may enhance the behavior and development of infants of depressed mothers. The infants were first more alert and then showed less stress, and their sleep was enhanced. Over the treatment period, they gained more weight, appeared less stressed (lower cortisol and catecholamines), were more soothable and more sociable. These changes suggest that this therapy may be an effective way for depressed mothers to enhance their infants' development. Further research will be required to determine the underlying mechanisms for these massage-therapy effects.

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