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# Massage Therapy Effects

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*Massage therapy is older than recorded time, and rubbing was the primary form of medicine until the pharmaceutical revolution of the 1940s. Popularized again as part of the alternative medicine movement, massage therapy has recently received empirical support for facilitating growth, reducing pain, increasing alertness, diminishing depression, and enhancing immune function. In this article studies are reviewed that document these effects, and models are proposed for potential underlying mechanisms.*

**M**assage therapy is one of the oldest forms of treatment in the world, having first been described in China during the second century B.C. and soon after in India and Egypt. Hippocrates, in 400 B.C., defined medicine as "the art of rubbing." Massage therapy disappeared from the American medical scene at approximately the time of the pharmaceutical revolution of the 1940s. Now considered an "alternative" therapy, it is becoming popular again as part of the alternative medicine movement. At this time, it is commonly defined by massage therapists as the manipulation of soft tissue by trained therapists for therapeutic purposes. Despite its long history and popularity, a Medline search yielded only approximately 200 articles from the last 30 years. Much of this literature suffers from classic methodological problems. First, although the literature has focused on clinical conditions, very few studies are based on clinical trials. Typical sampling problems are the failure to include control groups and the lack of random assignment to treatment and control conditions. Often, the participants have served as their own controls, and the measures were simply collected at the beginning and the end of the treatment period. Although within-subject controls are important in controlling for individual differences, treatment individuals need to be compared with nontreatment or comparison-treatment individuals. Using a within-subjects design alone could result in effects that might be explained otherwise by spontaneous recovery, a placebo effect, and statistical regression. The control group would optimally be an attention control or a comparison-treatment control to avoid the possibility that the therapist's attention alone explained the effects.

A second problem is the very small sample sizes used in most of the studies and that the treatment group often received more than one type of treatment. Another problem is the potential for initial level effects where the

treatment may have differential effects depending on the initial level of the participants. This, in itself, could explain many of the mixed findings. Still another problem is the use of inappropriate statistics. Only two meta-analyses appear in the literature. This has occurred because there are not enough studies with comparable designs and standards, and too many different massage therapy techniques have been used across the studies. Very few replications and virtually no follow-up studies have been conducted. Although one might not expect massage therapy to have sustained effects any more than temporary drugs, diet, or exercise, follow-ups are needed to assess that question. Finally, there would appear to be a publication bias where inevitably positive results are published, and negative results lay idle.

For the above reasons, I have conducted, along with colleagues at the Touch Research Institute, a number of massage therapy studies, focusing on a variety of different conditions that might benefit from massage therapy. In each of these studies there was a theoretical reason to expect positive results. In addition, other studies from the literature were included in this review if they met the criteria of adequate sample size determined by power analysis and random assignment to a treatment group, a comparison treatment, or an attention control group.

The massage therapy technique used throughout all of these studies, unless otherwise specified, involved deep tissue manipulation with presumed stimulation of pressure receptors. Unless otherwise specified, adult studies involved eight sessions (two per week for four consecutive weeks) of 30 minutes duration, and all child sessions were performed by parents on a nightly basis for 30 days for 15 minutes duration. The parameters for the adult sessions were based on practical considerations, namely that most adults could not afford more than two half-hour sessions per week by a professional or by a significant other. The parameters of the child sessions were based on the consideration that children with chronic illness may benefit from a "daily dose" and

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that their parents could also benefit from providing the massage at no monetary expense to themselves.

The studies are grouped thematically by the primary objective of treatment, for example, facilitating growth or reducing pain. They are organized in a sequence that may seem arbitrary but one that seems to capture the longitudinal progression from primary agendas early in life to those later in life as, for example, focusing on facilitating growth in premature infants for the early life agenda to enhancing immune function, a more primary agenda for later in life. An attempt was made throughout to address potential underlying mechanisms that are unique to the different conditions as well as to discuss an overarching potential mechanism for massage therapy across conditions. Thus, the order selected is facilitating growth; reducing pain; increasing alertness; diminishing stress, anxiety, and depression; and enhancing immune function.

## **Enhancing Growth**

### ***Animal Models***

Data from research on rat and monkey models support the use of touch as therapy. In a recent model developed by Saul Schanberg and colleagues, rat pups were first removed from their mother to investigate touch deprivation (Schanberg, 1994). Then, the mother's behavior was simulated to restore the physiology and biochemistry of the rat pups to normal. In several studies, a decrease was noted in growth hormone (ornithine decarboxylase) when the pups were removed from their mother. This decrease was observed in all body organs including heart, liver, and brain and in all parts of the brain including the cerebrum, cerebellum, and brain stem. These values returned to normal when the pups were stimulated using techniques

approximating the mother's behavior. A graduate student observed rat mothers' nocturnal behavior and noted that they frequently tongue lick, pinch, and carry around the rat pups. When the researchers tried each of these maneuvers, only the tongue licking (simulated by a paintbrush dipped in water and briskly stroked all over the body of the rat pup) restored the growth hormone values to their normal level. Because thermo-regulation might also be a factor, the same study was conducted with an anesthetized mother rat (Schanberg, 1994). The pups could still suckle and maintain their body temperature by continuous contact with the mother rat but were not being tongue licked. The pups experienced similar decreases in growth hormone. More recently, Schanberg and his colleagues discovered a near immediate gene underlying protein synthesis that responds to tactile stimulation, suggesting genetic origins of this touch-growth relationship (Schanberg, 1994).

Related studies by Meaney et al. (1990) suggest a long-term impact of handling on the modulation of cortisol (stress hormone) production. Rats who were handled more as pups showed less corticosteroid production, more elaborate dendritic arborization in the hippocampal region, and better maze performance (memory function) in the aging rat. It is, of course, also possible that increased cortisol or increased stress could accelerate development, as in some animal models, and it is also possible that the enhanced hippocampal development may be mediated by some third element, for example, another neurotransmitter or neurohormone. For example, increased serotonin might account for both effects. Parallels in the decreased cortisol-increased hippocampal development relationship have already been noted in human infants at the Hammersmith Hospital in London. Research by Modi and Glover (1995) provided similar documentation of lower cortisol levels in massaged preterm infants, and they currently are examining magnetic resonance imaging (MRI) data for examples of faster development of the hippocampal region in those infants. In a sample of very premature (29 weeks median gestational age) and very low birthweight ( $Mdn = 980$  g), neonates' cortisol concentrations decreased consistently after massage. Modi and Glover are using a computerized subtraction method to document hippocampal development across MRIs taken before and after the massage treatment period. The rat model developed by Meaney et al. for decreased cortisol leading to hippocampal development may have good parallels in the Modi and Glover preterm-infant model just as the Schanberg (1994) rat model for stimulation-induced growth has been a good model for massage-induced weight gain in the preterm infant.

Greater weight gain has been reported in several studies on preterm infants, including those who are cocaine-exposed and HIV-exposed. In the preterm-infant studies, Swedish massage or heavy stroking (stroking with pressure) was used. Although infants, particularly premature infants, may seem to be fragile, some pressure is needed for the massage to be effective. A review of the infant massage literature suggests that those who used

light stroking did not report weight gain, for example, whereas those who used stroking with pressure reported weight gain (Scafidi et al., 1986).

### **Preterm Infants**

In a series of studies I recently reviewed (Field, 1998), preterm infants in the neonatal intensive care unit were given 15-minute massages three times a day for 10 days while they were still in the incubator (massaged through the incubator portholes; Field et al., 1986; Scafidi et al., 1990). The treated infants compared with control infants gained 47% more weight and were hospitalized for six days less at a hospital cost savings of \$10,000 per infant. Norepinephrine and epinephrine levels increased in the massaged infants relative to the control infants (who did not receive massage therapy) across the treatment period. Because these neurotransmitters normally increase during the neonatal period, this finding was interpreted as massage therapy facilitating the normal developmental increase in these catecholamines in preterm infants during their newborn period (Kuhn et al., 1991). Finally, the treated infants performed better on the Brazelton Neonatal Behavior Assessment Scale (Brazelton, 1973).

At one year the treated infants were still showing a weight advantage, and they also performed better on the Bayley Scales of Infant Development (Field, Scafidi, & Schanberg, 1987). Their scores averaged 12 points higher on the mental scale and 13 points higher on the motor scale than the control group. The infants' more responsive behavior on the Brazelton Neonatal Behavior Assessment Scale apparently elicited more stimulation from their parents, which led to the later gains in growth and development.

Replication studies have been conducted in Israel (Goldstein-Ferber, 1998) and the Philippines (Jinon, 1996). In the Philippines study (Jinon, 1996) which was an exact replication of the Field et al. (1986) methodology, the preterm infants who were massaged gained 45% more weight than the nonmassaged infants. In the Israeli study (Goldstein-Ferber, 1998), which used mothers as therapists, 31% greater weight gain was reported for the massaged versus control preterm infants. In addition, the mothers who provided the massage experienced a decrease in depression. The Philippine and the Israeli studies respectively approximated the weight gain data (45% and 31%) published a decade ago (47%) by Field et al. (1986) and Scafidi et al. (1990; 31%) respectively. Finally, a recent study by Dieter, Field, and Hernandez-Reif (1998) suggested that a 46% greater weight gain can be achieved in preterm infants following only one week of massage.

### **Cocaine-Exposed Infants**

Similar weight gains were noted in a study on cocaine-exposed infants who were massaged versus those who were not (Wheeden et al., 1993). In addition, these infants showed superior motor behavior.

### **HIV-Exposed Infants**

In a study on HIV-exposed infants, the mothers of the infants were used as the massage therapists. The mothers' treatment compliance rates were very high, perhaps because of the guilt they expressed for having exposed their infants to HIV and their own high anxiety levels (Scafidi & Field, 1996). Teaching parents to massage their infants often lowers their anxiety levels that are related to their feelings of helplessness about their infant's or child's condition. Helping with their children's treatment might be expected to decrease their anxiety levels and make them feel that they are contributing to the treatment. In addition, daily massages are economically feasible when the parents are used as therapists. In the study on HIV-exposed infants, the massaged infants' weight gain was significantly greater than the control group who did not receive massage therapy, and massaged infants showed significantly fewer stress behaviors. The parents' involvement and their own reduced stress can be thought of as a confounding or a contributing variable in all studies using parents as the massage therapists.

### **Full-Term Infants**

In a study of 40 full-term one- to three-month-old infants born to adolescent mothers, infants were given 15 minutes of either massage or rocking for 12 days over a six-week period. During the massage sessions, the massaged versus the rocked infants (a) spent more time in active alert and active awake states; (b) cried less; (c) had lower salivary cortisol levels, suggesting lower stress levels; and (d) spent less time in an active awake state after the massage session (as opposed to the rocking session), suggesting that massage may be more effective than rocking for inducing sleep (Field, Grizzle, Scafidi, Abrams, et al., 1996). Analyses of the longer term effects suggested that by the end of the six-week treatment period, the massage group infants (a) gained more weight; (b) improved on emotionality, sociability, and soothability temperament dimensions; (c) showed better face-to-face interaction behaviors; (d) had decreased urinary stress hormones (cortisol) and catecholamines (norepinephrine, epinephrine); and (e) had increased serotonin levels.

Converging data may suggest a potential underlying mechanism for the massage therapy-weight gain relationship. Uvnas-Moberg, Widstrom, Marchini, and Windberg (1987) reported that stimulating the inside of the mouth of the newborn led to the increased release of gastrointestinal food absorption hormones, including gastrin and insulin. Field et al. (1982) reported that sucking on a pacifier during gavage feedings led to significantly greater weight gain in preterm infants. Stimulating the entire body, as in massage therapy, leads to increased vagal activity and insulin levels (Field, 1995) as well as increased weight gain (Field et al., 1986). The "vegetative" branch of the vagus is known to stimulate the release of food absorption hormones including insulin and gastrin (Uvnas-Moberg et al., 1987). The massaged infants in the above studies did not eat more food and did

not sleep more, so they were not simply consuming or conserving more calories. Rather, the weight gain seems to have been mediated by an increase in vagal activity, which in turn facilitated the release of food absorption hormones (at least insulin).

The superior habituation performance (an index of newborn memory) noted at the neonatal period and superior performance on the mental scale of the Bayley Scales for Infant Development at one year (also related to infant memory skills) may derive from enhanced hippocampal development. As noted earlier, Meaney et al. (1990) tracked a relationship between increased glucocorticoids, decreased dendritic arborization in the hippocampal region, and inferior maze performance, suggesting impaired memory function in the aging rats that had been deprived of tactile stimulation as rat pups. Similarly, the more elaborate dendritic arborization noted in MRIs of the hippocampal region in massaged preterm neonates by Modi and Glover (1995) may be related to the superior memory performance noted in the massaged newborns and their performance again at one year of age.

### ***Pregnancy Massage***

Preterm delivery may result from pregnancy anxiety, depression, and related obstetric complications. Because anxiety, depression, and related stress hormones can be decreased by massage therapy, as has been noted in many studies (see section on alleviating stress, depression, and anxiety), massage therapy was expected to have similar effects on pregnant women. In many countries pregnant women are massaged several times daily for relaxation and to reduce their anxiety levels (Older, 1982). In a recent study pregnant women who were massaged versus pregnant women who experienced relaxation therapy reported lower anxiety and depression, and had lower stress hormone levels (cortisol and norepinephrine; Hernandez-Reif, Field, Hart, et al., in press). The massaged women experienced less sleep disturbance and less pregnancy pain (lower back and leg pains), and fewer obstetric and postnatal complications including lower prematurity rates.

## **Pain Reduction During Painful Procedures**

### ***Childbirth Labor***

In this study significant others of pregnant women were taught to massage the women during childbirth versus a control group, who received the standard breathing coaching throughout labor (Field, Hernandez-Reif, Taylor, et al., 1997). The massaged women had lower anxiety and depression scores, decreased cortisol levels, less need for medication, shorter labor, fewer days in the hospital, and less postpartum depression. In current research we are assessing the possibility that massage therapy stimulates oxytocin, which in turn could facilitate labor progression. Studies are needed to monitor the fetal response to the mother's reduced pain and decreased time in labor as well as the neonatal outcome.

### ***Massage Therapy Prior to Debridement for Burn Patients***

Massage therapy has also been used to reduce anticipatory anxiety prior to debridement (skin brushing for severe burns) and to indirectly alleviate pain during that procedure (Field, Peck, et al., 1998). After a five-day course of 30-minute massages prior to debridement, burn patients had lower anxiety levels and associated decreases in stress hormones (cortisol). Depression also decreased by Day 5, probably because of the decrease in pain.

### ***Postoperative Pain***

An equivalent-groups design with a treatment group of 19 patients and a control group of 20 patients was used to investigate the impact of massage therapy on patients' perceptions of postoperative pain (Nixon, Teschendorff, Finney, & Karnilowicz, 1997). Controlling for age, the results indicated that massage produced a significant reduction in patients' perception of pain over a 24-hour period.

## **Reducing Pain in Chronic Pain Conditions**

### ***Juvenile Rheumatoid Arthritis***

Chronic pain is a problem for children with juvenile rheumatoid arthritis. Antiinflammatory agents used for their pain have ceiling effects, and other drugs such as narcotics cannot be used due to their potentially addictive effects. Thus, massage therapy is being assessed for its usefulness for pain relief. In a study in which parents provided their children daily massages, several positive effects were noted (Field, Hernandez-Reif, Seligman, et al., 1997). The massaged children (versus the control children who received progressive muscle relaxation) experienced (a) decreased anxiety and cortisol after the first and last sessions, and (b) decreased pain and pain limitations on activities over the one-month period as reported by the children, their parents, and their physicians.

### ***Fibromyalgia***

In a study on fibromyalgia syndrome (pain all over the body for no known etiology), patients were randomly assigned to one of three conditions: massage therapy, transcutaneous electrical stimulation (TENS, a steel roller the size of a pen that transmits a small, barely discernible current as it is rolled across the body), or transcutaneous electrical stimulation without current (SHAM TENS) for 30-minute treatment sessions two times per week for five weeks (Sunshine et al., 1997). As compared with the TENS and SHAM TENS groups, the massage therapy patients reported lower anxiety and depression, and their cortisol levels were lower immediately after the therapy sessions on the first and last days of the study. The massage therapy group also showed greater improvement on a dolorimeter measure of pain, and they reported less pain, stiffness, and fatigue and fewer nights of difficult sleeping.

## **Lower Back Pain**

Lower back pain is one of the most frequent causes of absenteeism and workers' compensation claims. Massage therapy appears to provide pain relief. In one study, 24 adults with chronic lower back pain were randomly assigned to a massage therapy or a progressive muscle relaxation group (Hernandez-Reif, Field, Krasnegor, et al. 1998). Sessions were 30 minutes long and were conducted twice a week for five weeks. By the end of the study, the massage therapy group showed significant improvement in range-of-motion tests, and they reported less pain and anxiety and improved mood. They also had lower depression scores and higher serotonin and dopamine levels by the end of the treatment. Taken together, these data suggest that massage therapy is an effective primary treatment for chronic lower back pain.

Another study on lower back pain involved massaging the hamstring muscle group of one randomly assigned lower extremity in a group of normal adults (Crosman, Chateauvert, & Weisberg, 1984). This treatment was considered relevant inasmuch as lower back pain is often exacerbated by tight hamstrings. The participants were given a 9 to 12-minute massage treatment to the posterior aspect of one leg. Passive range of motion of both lower extremities was measured by taking the perpendicular distance from the floor to a table surface in a straight leg raise and by conventional goniometry for hip flexion and knee extension. Measurements were taken before and after immediate massage and seven days post-massage treatment. Immediate postmassage increases in range of motion were noted in the massaged legs and not in the nonmassaged legs.

## **Migraine Headaches**

At least two studies have suggested that massage therapy is also effective for migraine headaches. In one study, 26 adults with migraine headaches were assigned to a massage therapy or a standard treatment control group (a group that received medications only for migraines; Hernandez-Reif, Dieter, et al., in press). By the last day of the study the massage therapy group showed fewer distress symptoms, reported less pain, had more headache-free days, were taking fewer analgesics, and having fewer sleep disturbances, and their serotonin (5HTAA in urine) levels were higher.

In a second study (Puustjarvi, Airaksinen, & Pontinen, 1990), 21 female patients suffering from chronic tension headaches received 10 sessions of upper-body massage consisting of deep tissue techniques. When found, trigger points were carefully and forcefully massaged. The range of cervical movement, surface electro-neuromyography (ENMG) on the frontalis and trapezius muscles, scores on Visual Analogue Scale (VAS) and the incidence of neck pain during a two-week period before and after the treatment, together with the Beck Depression Inventory (BDI) were taken for evaluation and follow-up. The range of movement in all directions increased, and the VAS, and the number of days with neck

pain decreased significantly. A significant change also occurred in ENMG on the frontalis muscle, and scores on the BDI showed significant improvement after the treatment.

## **Potential Models for Mechanisms of Touch and Pain Relief**

**Gate theory.** Pain alleviation has most frequently been attributed to the gate theory (Melzack & Wall, 1965). This theory suggests that pain can be alleviated by pressure or cold temperature because pain fibers are shorter and less myelinated than pressure and cold temperature receptors. The pressure or cold temperature stimuli are received by the brain before the pain stimulus, the gate is closed and thus the pain stimulus is not processed.

**Serotonin.** Another possibility is increased serotonin levels after massage therapy for both infants (Field, Grizzle, et al., 1996) and adults (Hernandez-Reif et al., in press; Ironson et al., 1996). Serotonin may inhibit the transmission of noxious nerve signals to the brain.

**Sleep deficits.** Another potential theory for pain alleviation from massage therapy relates to quiet or restorative sleep. During deep sleep, somatostatin is normally released (Sunshine et al., 1997). Without this substance, pain is experienced. Substance P is released when an individual is deprived of deep sleep, and substance P is notable for causing pain (Sunshine et al., 1997). Thus, when people are deprived of deep sleep they may have less somatostatin and increased substance P, which results in greater pain. One of the leading theories for the pain associated with fibromyalgia syndrome, for example, is the production of substance P due to deep sleep deprivation (Sunshine et al., 1997). One of the possible reasons the participants with fibromyalgia syndrome in the Sunshine et al. study experienced less pain following the massage therapy treatment period is because they were experiencing less sleep disturbance.

## **Reducing Neuromuscular Problems**

### **Multiple Sclerosis**

Ambulation is a significant problem for patients with multiple sclerosis. Because massage therapy involves deep manipulation of muscles and can increase range of motion, it might be expected to improve ambulation. In a recent study, 24 adults (*M* age = 48 years) diagnosed with multiple sclerosis and requiring unilateral support to walk were assigned to a massage therapy or a control group (Hernandez-Reif, Field, Theakston, & Field, 1998). The massage therapy group received 30-minute massages twice a week for five weeks. The effects of the massage were assessed immediately after the massage using self-reports on stress levels and grip strength tests, and longer-term effects were assessed at the end of the study using self-reports on body image, self-esteem, depression, and functional activities including ambulation. Although both groups reported being less anxious after the first and last day of the study, only the massage group reported less depressed mood. In

addition, by the end of the study, the massage group's social lifestyle and functional activity status had improved significantly. However, grip strength was unaffected, and ambulation was only marginally improved.

### **Spinal Cord Injury**

Two major problems for spinal cord injury patients are restricted range of motion and muscle atrophy in the unaffected areas. Massage therapy might be expected to alleviate at least the range of motion problem, as it did in the lower back pain study just reviewed. Twenty patients with spinal cord injury at the C5–C7 spinal cord level were assigned to a massage therapy or a control group (Diego et al., 1998). The massage therapy group received 30-minute massages twice a week for five weeks. The massages focused on participants' shoulders, arms, hands, and back muscles. The effects of the massage were assessed immediately after the session using self-reports on anxiety and mood, and the longer term effects were assessed at the end of the study by physical therapists (unaware of group assignments) who evaluated activities of daily living, passive and active range of motion, and muscle activity. Participants in the massage group reported less anxiety and better mood following the five-week study. In addition, significant improvement occurred on functional living activities and in wrist and elbow range of motion.

A series of studies have addressed the effects of massage therapy on the Hoffmann reflex (H-reflex) amplitude in persons with a spinal cord injury. The studies, conducted by Morelli and colleagues (Morelli, Seaborne, & Sullivan, 1990, 1991; Sullivan, Williams, Seaborne, & Morelli, 1991), are considered among the best controlled massage therapy studies in the literature because of their reliance on the more objective neurophysiological measures. The purpose of this group of studies was to investigate the effects of massage therapy on neuromuscular excitability as measured by changes in the H-reflex. A reduction in the H-reflex amplitude is critical to the comfort of spinal cord injury patients for reducing cramps and spasms. In these studies, the H-reflex peak-to-peak amplitude was measured during and following a three-minute massage to the triceps muscle. Typically a 60%–80% decrease in the H-reflex amplitude was observed during the massage followed by a return to baseline levels immediately following the termination of the massage. In contrast to the activation of cutaneous receptors by light fingertip pressure, this stimulation of deep tissue receptors by tendon pressure muscle vibration inhibits activities along the reflex pathway as measured by the H-reflex. This suggests that deep lying receptors override the influences exercised by superficial cutaneous receptors.

### **Enhancing Attentiveness**

#### **Attention Deficits**

**Autism.** One of the most salient problems of children with autism is their inattentiveness. Although they have also been anecdotally described as being extremely

sensitive to touch and as typically disliking being touched, they showed surprisingly little resistance to being massaged in a recent study (Field, Lasko, et al., 1997). Massage may not have been aversive to them because it is predictable, unlike the social stimulation they frequently resist, and because it involves pressure. The children who were massaged as opposed to the children who were held by their teachers and shown objects showed a decrease in their off-task behavior in the classroom following a 10-day period of massage. Their "social relatedness" to their teachers also improved, and they showed fewer autistic behaviors (orienting to sounds and stereotypic behaviors; Field, Lasko, et al., 1997).

#### **Attention Deficit Hyperactivity Disorder (ADHD).**

Children with ADHD have similar problems staying on task in the classroom. In a recent study, adolescents with ADHD were provided massage therapy or relaxation therapy for 10 consecutive school days (Field, Quintino, & Hernandez-Reif, 1998). The massage therapy group, compared with the relaxation therapy group, showed less fidgeting behavior following the sessions. In addition, after the two-week period, their scores on the Conners Scale (Conners, 1985) completed by their teachers (who were unaware of the group assignments) suggested that the children spent more time on-task and were less hyperactive in the classroom.

#### **Enhancing Alertness**

In a job stress study medical school faculty and staff received 15-minute chair massages during their lunch breaks (Field, Ironson, et al., 1996). These sessions involved deep pressure in the head, neck, shoulders, and back regions. Surprisingly, instead of becoming sleepier after their midday massage, the participants reported experiencing heightened alertness, much like a runner's high. EEG recordings before, during, and after the massage sessions confirmed the participants' impressions. As compared with a group of relaxation therapy participants, their levels of alpha wave activity significantly decreased during massage (in contrast to alpha levels typically increasing during sleep), suggesting a pattern of heightened alertness. A math computation task was added to determine whether this EEG pattern of heightened alertness translated into performance. Following the massage sessions, the computation time was significantly reduced, and computation accuracy increased.

### **Alleviating Stress, Depression, and Anxiety**

#### **Post-traumatic Stress Disorder**

Post-traumatic stress disorder is characterized by depression and behavior problems in children. Many children showed post-traumatic stress symptoms following Hurricane Andrew, and several of the children's disciplinary problems in the classroom were exacerbated by the hurricane (Field, Seligman et al., 1996). After a month of massage therapy (two times per week) their symptoms and their depression decreased in contrast to a control

group (who watched a relaxing video). Anxiety also decreased, and self-image improved as reflected in their self-drawings. A girl's self-drawing, for example, on the first day was very small, had dark colors, and no facial features. By the last day, she drew a birthday party with balloons, sunshine and birds, and friends attending the party.

### ***Child and Adolescent Psychiatric Patients***

In a study on hospitalized depressed children and adolescents (Field et al., 1992), those who received back massages for a week versus those who viewed relaxing videotapes (control group) were less depressed and anxious and had lower stress hormone levels (lower saliva cortisol levels as well as lower urinary cortisol and norepinephrine levels), and time-lapse videotapes of their sleep-wake behavior revealed more organized sleep patterns. In addition, the nurses on the unit rated the massaged adolescents as being less anxious and more cooperative by the last day of the study. In a similar pilot study on adult patients with anxiety, massaged patients showed a decrease in stress response patterns including decreased heart rate, electromyography (EMG), and skin resistance (McKechnie, Wilson, Watson, & Scott, 1983).

In a related study, 32 depressed adolescent mothers received ten 30-minute sessions of massage therapy or relaxation therapy across a five-week period (Field, Grizzle, Scafidi, & Schanberg, 1996). Although both groups reported lower anxiety following their first and last therapy sessions, only the massage therapy group showed behavioral and stress hormone changes, including decreases in anxious behavior, pulse, and salivary cortisol levels. A decrease in urine cortisol and norepinephrine levels suggested lower stress following the five-week period for the massage therapy group.

### ***Eating Disorders in Adolescent Women***

Another group of people who experience severe depression are adolescents with eating disorders including bulimia (overeating and vomiting) and anorexia. Adolescents with bulimia who received one month of twice weekly massages plus their standard daily group therapy treatment (versus adolescents with bulimia who only received the standard group therapy) had (a) fewer symptoms of depression, (b) lower anxiety levels, and (c) lower stress hormone levels (urinary cortisol levels; Field et al., in press). Their eating habits also improved, and their body image was less distorted. In a similar study on adolescents with anorexia at the same hospital the massaged women (versus the standard group therapy control women) reported lower anxiety levels and had lower stress hormone levels (cortisol levels; Hart, Field, Hernandez-Reif, Shaw, & Schanberg, 1997). Over the one-month treatment period they also reported less body dissatisfaction on the Eating Disorder Inventory (Garner, Olmsted, & Polivy, 1983) and had increased dopamine levels.

### ***Chronic Fatigue***

Depression is also a problem for adults with chronic fatigue syndrome. In a recent study with this population, participants were randomly assigned to a massage therapy or a SHAM TENS (transcutaneous electrical stimulation) control group (Field, Sunshine, et al., 1997). Immediately after the sessions on the first and last days of the study, the massage therapy participants, versus the SHAM TENS participants, had lower depression and anxiety scores and lower stress hormone (salivary cortisol) levels. Longer term effects (last day vs. first day) indicated that the massage therapy group was experiencing fewer symptoms of depression as well as fewer somatic symptoms, more hours of sleep, lower urinary cortisol levels, and elevated urinary dopamine levels.

### ***Depressed Elderly Volunteers Massaging Infants***

In this study a group of depressed, elderly people were recruited to massage infants and to receive massage. (Field, Hernandez-Reif, Quintino, et al., 1997). In a counterbalanced design, grandparent volunteers were giving a massage daily for one month, and then they were massaged themselves for one month (Field, Hernandez-Reif, Quintino, et al., 1997). Their depression scores decreased following a one-month period of massaging the infants, and they experienced increased self-esteem and decreased cortisol levels. The grandparent volunteers benefited more from giving than from receiving the massage, perhaps because, as they reported, they felt "awkward" receiving massages. Their affect and self-esteem improved more following the one-month period of giving massage versus receiving massage, as did their lifestyle habits (e.g., they reported drinking fewer cups of coffee per day, they made more social phone calls, and they made fewer trips to the doctor's office).

### ***Models Underlying Touch Alleviating Depression***

Depressed mood was decreased, and anxiety levels and stress hormones (norepinephrine, epinephrine, cortisol) were reduced in all of the above studies. One potential mechanism is suggested by a recent study measuring frontal EEG activation following massage in depressed adolescents (Jones & Field, in press). Shifts to a more positive mood were notably accompanied by shifts from right frontal EEG activation (normally associated with sad affect) to left frontal EEG activation (normally associated with happy affect) or at least to symmetry (midway between sad and happy affect) in both the mothers and their infants. Right frontal EEG activation (noted in chronically depressed adults and also observed in the depressed mothers and infants in our study) was shifted toward symmetry following a 20-minute massage (Jones & Field, in press). Chemical and electrophysiological changes from a negative to a positive balance may underlie the decrease in depression noted following massage therapy.

A related potential mechanism may be the increase noted in vagal activity following massage therapy (Field,

1995). The nucleus-ambiguous branch of the vagus (the "smart" vagus) stimulates facial expressions and vocalizations, which contribute to less depressed affect, which in turn could feedback to effect less depressed feelings (Porges, 1997).

## **Cardiovascular Symptoms of Stress**

Fifteen-minute massages significantly lowered blood pressure in 52 participants monitored before and after the massage sessions at work (Cady & Jones, 1997). Both systolic and diastolic blood pressures were decreased. In a group of chronically high blood pressure participants, massage therapy reduced only diastolic blood pressure (Hernandez-Reif et al., 1998). The mechanism for these decreases is not known and highlights the need for further study.

## **Autoimmune Disorders**

### **Diabetic Children**

In a study on the vagal activity and insulin levels following massage therapy, I had reported (as described earlier) that both vagal activity and insulin levels increased (Field, 1995). This led to the investigation of massage therapy effects on diabetic children's clinical course. In this study we used parents as therapists because the cost of daily massages was prohibitively expensive and because we knew that massaging children had helped the therapists (the volunteer grandparents) as well (Field, Hernandez-Reif, Shaw, et al., 1997). Involvement in the treatment of their children can be a particularly negative experience for parents of diabetic children, for example, monitoring dietary compliance, taking blood samples, and giving insulin shots. In this study parents were given a more positive role in their children's treatment by massaging their children daily before bedtime. Immediately after the massage-therapy sessions, parents' anxiety and depressed mood levels were lower, and their children's anxiety levels and depressed mood levels were also lower. At the end of the one-month period, the parents' assessment of their children's insulin and food regulation improved, and the children's blood glucose levels decreased from very high to normal range values (from 158 to 118).

### **Asthmatic Children**

Assuming that massage therapy might similarly benefit asthmatic children, we had parents give daily 20-minute bedtime massages to their asthmatic children (Field, Henteleff, et al., 1998). Immediately after the massage (a) the parents' anxiety decreased, (b) the children's self-reported anxiety levels decreased, (c) the children's mood improved, and (d) the children's cortisol levels decreased. Most important, over the one-month period, the children had significantly fewer asthma attacks and significantly improved pulmonary functions, including peak air flow, forced vital capacity, forced expiratory volume, average flow rate, and peak expiratory flow rate.

## **Immune Disorders**

### **HIV-Positive Adults**

Immune disorders might be expected to benefit from massage therapy because of the decrease in cortisol levels noted in several previous studies. Elevated cortisol is known to dampen immune function. In a study we conducted on HIV-positive adults, natural killer (NK) cells and natural killer cell cytotoxicity (activity) increased following 20 days of massage therapy (Ironson et al., 1996). Twenty-nine gay men (20 HIV+, 9 HIV-) were massaged for one month and compared with a progressive muscle relaxation group. A subset of 11 of the HIV-positive men served as a within-subjects control group (one month with and one month without massages). Major immune findings included a significant increase in NK cell number, NK cell cytotoxicity, and subsets of CD8 cells. There were no changes in HIV disease progression markers (CD4, CD4/CD8 ratios), possibly because the HIV men were already severely immune compromised. A significant decrease was also noted in urinary cortisol, and nonsignificant trends suggested decreased catecholamines. Decreased anxiety was significantly correlated with increased NK cell number.

Elevated stress hormones (catecholamines and cortisol) are noted to negatively affect immune function. The increase in cytotoxic capacity associated with massage therapy probably derives from the decrease in these stress hormones following massage therapy. Because NK cells are the front line of defense in the immune system, combating the growth and proliferation of viral cells, the HIV-positive patients who received the massage therapy might experience fewer opportunistic infections such as pneumonia and other viruses that often kill them. The increased NK cells also suggest that cancer patients may benefit from massage therapy inasmuch as NK cells are also noted to combat cancer cells.

### **Breast Cancer**

Nineteen women (*M* age = 53 years) with Stage I or II breast cancer were assigned to a massage therapy or control group (Hernandez-Reif, Field, Ironson, et al., 1998). The massage therapy group received three 45-minute massages per week for five weeks. Lymphocyte markers (CD56 + cells, CD3 + cells, CD11a+ cells) and NK cell numbers were significantly increased for the women in the massage group by the end of the study. Immediately after their first and last massage, the massage therapy group reported less anxiety, anger, and pain, and improved mood. Longer term changes for the massage therapy group included improved body image awareness and physical well-being, and decreased depression.

## **Summary**

These, then, are the functions that have improved following massage therapy. In addition to each clinical condition being marked by unique changes such as the increased peak air flow noted in the asthma study and the decreased glucose levels noted in the children with diabetes, there



was also a set of common findings. Across studies, decreases were noted in anxiety, depression, stress hormones (cortisol), and catecholamines. Increased parasympathetic activity may be the underlying mechanism for these changes. The pressure stimulation associated with touch may increase vagal activity, which in turn lowers physiological arousal and stress hormones (cortisol levels). The pressure is critical because light stroking is generally aversive (much like a tickle stimulus), and the above effects have not been noted for light stroking. Decreased cortisol in turn leads to enhanced immune function. Parasympathetic activity is also associated with increased alertness and better performance on cognitive tasks (Porges, 1997). Given that most diseases are exacerbated by stress and that massage therapy alleviates stress, this alternative treatment may help reduce stress-related disease.

Future directions for research may be discussed in the context of the most frequently raised questions about massage therapy. Those include the questions of whether massage therapy effects can be demonstrated in an equivalent way for healthy volunteer individuals in experimental conditions in contrast to the typical demonstration on individuals with medical conditions. Additionally, can the massage therapy effects occur using mechanical massage stimulation as opposed to human massage therapy? A third frequently raised question has to do with the underlying mechanism for the effects of massage therapy. Other occasionally raised questions are whether massage therapy has lasting effects, whether there are contraindications for massage therapy, and whether any particular massage therapy techniques are more effective than others.

The literature has been equivocal about the question of massage therapy effects on healthy individuals. Most studies have focused on alleviating symptoms and combating disease, and literally no prevention studies appear in the literature. Probably the closest massage therapy literature that addresses the question is the literature focusing on sports and the effects of athletic massage. This, however, is a mixed-results literature. Typically the studies have focused on the effects of athletic massage on delayed onset muscle soreness and waste products. In such studies it is hypothesized that athletic massage administered after extensive exercise (typically two hours after the exercise) would disrupt an initial crucial event in acute inflammation and the accumulation of neutrophils. This would result in a diminished inflammatory response and a concomitant reduction in delayed onset muscle soreness and waste products. Generally, assessments are made before the exercise and at several intervals after the exercise. In many studies the effects are positive, but in other studies negative results occurred. The conflicting results have stimulated at least three reviews of that literature. As for many of the questions, the assessment tools that we have may simply not yet be sufficiently developed. Measurement technology has, as already mentioned, been one of the most limiting problems in conducting massage therapy research.

The question of whether mechanical stimulation is as effective as stimulation provided by a massage therapist has never been addressed by directly comparing the two. However, an extensive literature on vibrator stimulation (most of which comes from Sweden) suggests significant therapeutic effects at least for pain reduction (Lundeberg, 1984; Lundeberg, Abrahamsson, Bondesson, & Haker, 1987, 1988; Ottoson, Ekblom, & Hansson, 1981). In these studies, vibration, typically at 100 Hz, is applied to various points in different locations; in one study to the facial region affected by dental pain and in another study to different areas of the body in a patient suffering chronic musculoskeletal pain. Typically patients have reported a pain intensity reduction of 75%–100%. The greatest pain reduction occurred either in the area of pain, the affected muscle or tendon, the antagonistic muscle, or a trigger point outside the painful area. In most patients the greatest pain-reduction effect occurred when the vibratory stimulation was applied with moderate pressure. To obtain a maximum duration of pain relief the stimulation had to be applied for about 25–45 minutes. After 12 months of treatment most patients reported a greater than 50% reduction in analgesic drug intake, and in one study the vibratory stimulation was a more efficient pain suppressor than aspirin. Double-blind studies where the vibratory stimulator was compared with a “placebo unit” (the vibrator turned on to make the sound but not vibrating) also revealed significant vibrator effects. A more direct assessment of this question is needed in which vibrator therapy is compared with manual therapy using the same participants with the same condition. Still another important question is whether self-massage can be as effective as being massaged by another individual.

The third question on underlying mechanisms has rarely been addressed. The most common theory that is based on anecdotal data and a very mixed empirical literature is that of massage increasing circulation or blood flow. Much of the literature suggesting that massage enhances circulation is an old literature that has been reviewed by Wakim (Wakim, Martin, Terrier, Elkins, & Krusen, 1949). As early as 1900 one author reported that after massage cutaneous temperature increased three degrees. A subsequent study demonstrated an increase in the diameter and permeability of the capillaries following mechanical stimulation in frogs and mammals. In a later study investigators measured skeletal muscle blood flow before, during, and after different forms of massage using a more sophisticated method for determination of blood flow, called the Xenon washout method. During rigorous massage blood flow increased comparable with exercise hyperemia (Hovind & Nielsen, 1974).

In contrast to the earlier studies, a very recent study (Shoemaker, Tidus, & Mader, 1997) reported a failure of manual massage to alter blood flow as measured by Doppler Ultrasound. The authors noted that the mean blood velocity and blood flows for the brachial and femoral arteries respectively were not altered by any of the massage treatments whether they were administered mild

or deep treatments in either the forearm or the quadriceps muscle groups. Mild voluntary hand grip and knee extension contractions, in contrast, resulted in peak blood flow for brachial and femoral arteries, respectively, which were significantly elevated from rest. Shoemaker et al. concluded that light exercise was more beneficial than massage in increasing blood flow. Although the Doppler Ultrasound methodology is the most sophisticated way to currently measure blood flow, the study suffered from several methodological problems, including the use of relatively little pressure (light Swedish massage was used) and a very small sample size (10 participants).

Another controversial literature involves sports massage. Several studies investigating the impact of massage on the reduction of delayed onset muscle soreness have concluded that massage was ineffective. However, in these studies massage was administered either immediately after exercise or 24–48 hours after exercise. In contrast, data from the Netherlands suggest that massage should be administered between one and three hours after the termination of strenuous exercise. Unlike the previous studies, Rodenburg, Steenbeek, Schiereck, and Bar (1994) found significant effects from administering the massage after exercise. They noted that the combination of a warm-up, stretching, and massage reduced some of the negative effects of exercise including the delayed onset muscle soreness and the creatine kinase activity in blood. However, some of their results were inconsistent, which may relate to their not having waited the full two hours to provide the massage. Their study was also confounded by combining three separate techniques including warm-up, stretching, and massage. Although suggesting that massage may be helpful for sports recovery and healthy individuals, the data also suggested the need for more tightly controlled studies that investigate the various parameters such as the time after exercise that massage is provided. Clearly, this variable alone contributed to significant inconsistency in the literature.

Other popularly posed questions, including the lasting effects of massage therapy following the termination of treatment, the contraindications for massage therapy, and the question of which techniques are the most effective, have not been addressed in the literature. Regarding the question of lasting effects, there is no reason to believe that massage effects would continue after the end of treatment anymore than drugs, diet, or exercise effects would be expected to persist. Contraindications such as varicose veins and cancer have been followed by massage therapists, although physician researchers in those areas refute the need for those contraindications. Clearly more research is needed on these questions.

In summary, these questions highlight the need for further research. Some of these questions have not yet been addressed, and many conditions have not been studied in methodologically sound ways. Replications are needed for the methodologically sound studies, and more mechanism studies will hopefully be conducted as more sophisticated measurement technology is developed. In the interim, at least the existing literature that is well-

controlled suggests that massage therapy may be a promising treatment.

Aside from the need for additional research and replication studies, there will need to be a shift in the social-political attitude toward touch. Increasing numbers of schools are mandating that teachers not touch children even as early as the preschool stage. The incidence of child abuse and litigations against teachers has increased even with these mandates, and the incidence of sexual harassment cases against adults has also increased despite the disappearing use of touch in social communication. This may be an American phenomenon as social communication touch is still very present in European cultures like France and Italy, and touch therapies such as massage are one of the most popular forms of treatment in European countries to the extent that they are covered by insurance carriers. Similarly, physicians in Asian countries are heavily prescribing touch therapies, and, ironically, continuing to invite American "experts" to provide lectures and workshops in touch therapy techniques, such as infant massage. The physicians in Asia may be treating massage therapy as modern technology because they perhaps do not remember that the origins of touch therapies were in their own part of the world thousands of years ago.

Touch therapies may have a greater chance than touch as social communication in the current U.S. climate as part of the healthy body trend along with diet and exercise. The increasing popular demand for alternative medicine may also help the return of massage therapy. In the interim, a larger body of methodologically sound research is needed to help inform this process.

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