Psychological Bulletin
2004, Vol. 130, No. 1, 3–18

0033-2909/04/$12.00 DOI: 10.1037/0033-2909.130.1.3

A Meta-Analysis of Massage Therapy Research

Christopher A. Moyer, James Rounds, and James W. Hannum
University of Illinois at Urbana–Champaign

Massage therapy (MT) is an ancient form of treatment that is now gaining popularity as part of the complementary and alternative medical therapy movement. A meta-analysis was conducted of studies that used random assignment to test the effectiveness of MT. Mean effect sizes were calculated from 37 studies for 9 dependent variables. Single applications of MT reduced state anxiety, blood pressure, and heart rate but not negative mood, immediate assessment of pain, and cortisol level. Multiple applications reduced delayed assessment of pain. Reductions of trait anxiety and depression were MT's largest effects, with a course of treatment providing benefits similar in magnitude to those of psychotherapy. No moderators were statistically significant, though continued testing is needed. The limitations of a medical model of MT are discussed, and it is proposed that new MT theories and research use a psychotherapy perspective.

Massage therapy (MT), the manual manipulation of soft tissue intended to promote health and well-being, has a history extending back several thousand years. Recorded in writing as far back as 2000 B.C. (Fritz, 2000, p. 13), massage was a part of many ancient cultures including that of the Chinese, Egyptians, Greeks, Hindus, Japanese, and Romans, and was often considered to be a medicinal practice (Elton, Stanley, & Burrows, 1983, p. 275). The Greek physician Hippocrates (460–377 B.C.) advocated rubbing as a treatment for stiffness; later, the physicians Celsus (25 B.C.–A.D. 50) and Galen (A.D. 129–199) wrote extensively on the medicinal and therapeutic value of massage and related techniques such as anointing, bathing, and exercise. However, in Western cultures, the association between massage and medicine eventually diminished as Greco-Roman traditions were abandoned. Although the practice of massage continued as a folk medicine treatment during the Middle Ages, its adoption by the common people served to separate it from the scientific and medical milieu, and in this way, massage fell out of favor with the medical establishment (Fritz, 2000; Salvo, 1999).

This schism continued during the early part of the 19th century, during which time Per Henrik Ling developed Swedish massage, the basis of many modern forms of MT. Ling, who was not trained in medicine, applied his ideas and techniques to the treatment of disease, a practice that met opposition from the Swedish medical community. Despite this resistance, Ling gained support from his influential clients and was eventually able to teach his system to physicians, who adopted his techniques and shared them with like-minded colleagues. Soon after, in the later part of the century, the Dutch physician Johann Mezger was successful in reintroducing massage to the scientific community, presenting it to his colleagues as a medical treatment, and codifying some of its elements with terms that are still in use today (Fritz, 2000, pp. 16–17; Salvo, 1999, pp. 9–11).

Interest in MT has continued to grow among the scientific community and consumers alike. Currently, in the United States, MT is one of the fastest growing sectors of the expanding complementary and alternative medical therapy movement. Visits to massage therapists increased 36% between 1990 and 1997, with consumers now spending between $4 and $6 billion annually for MT (Eisenberg et al., 1998), in pursuit of benefits such as improved circulation, relaxation, feelings of well-being, and reductions in anxiety and pain, all of which are endorsed as benefits of MT by the American Massage Therapy Association (AMTA, 1999b). At the same time, numerous studies across several fields including psychology, medicine, nursing, and kinesiology support MT's therapeutic value. Field (1998) reviewed the effectiveness of MT in treating symptoms associated with a host of clinical conditions, including pregnancy, labor, burn treatment, postoperative pain, juvenile rheumatoid arthritis, fibromyalgia, back pain, migraine headache, multiple sclerosis, spinal cord injury, autism, attention-deficit/hyperactivity disorder, posttraumatic stress disorder, eating disorders, chronic fatigue, depression, diabetes, asthma, HIV, and breast cancer. In addition to the beneficial outcomes that were unique to these specific conditions, Field proposed a set of common findings by indicating that "across studies, decreases were noted in anxiety, depression, [and] stress hormones (cortisol)" (p. 1278).

Even the popular press has picked up on the increase in MT practice and research. A feature in *Time* suggested that MT is on the rise, in part, because of "people's greater awareness of the effect stress has on health" (Luscombe, 2002, p. 49). It is also reported that the National Institutes of Health have begun funding MT research, and that the White House Commission on Complementary and Alternative Medicine Policy (2002) has called for

Christopher A. Moyer, James Rounds, and James W. Hannum, Department of Educational Psychology, University of Illinois at Urbana–Champaign.

We wish to thank Sue Duval, Carol Webber, and the Interlibrary Borrowing Staff at the Illinois Research and Reference Center, University of Illinois at Urbana–Champaign, for their invaluable contributions to this project. Patrick Armstrong and James Wardrop also contributed.

Correspondence concerning this article should be addressed to James Rounds, Department of Educational Psychology, University of Illinois at Urbana–Champaign, 1310 South Sixth Street, Champaign, IL 61820-6990. E-mail: jrounds@uiuc.edu

more research and public education on MT. The *Time* article concludes by noting that the Commission's chairman, physician James Gordon, indicates that MT is known to be effective in decreasing anxiety, reducing pain, and improving mood (Luscombe, 2002, p. 50).

If MT can be effective in the ways indicated by the AMTA, Field, and Gordon, it would represent a therapy of interest to a variety of fields. One can imagine its use expanding beyond the private practices of massage therapists, and extending to places such as hospitals, nursing homes, psychological treatment centers, sports performance clinics, and workplaces. In addition, MT could establish itself as a treatment supported by insurance carriers and health maintenance organizations. These are, in fact, trends that are already occurring in a limited way. Nevertheless, for these trends to continue (indeed, to determine if they even should continue), what is needed is a more rigorous and quantitative examination of MT's effectiveness than that which currently exists.

There are three meta-analyses of MT research, but each is very limited in scope. Ottenbacher et al. (1987) quantified 19 studies that examined the effects of tactile stimulation on infants and young children, and found statistically significant beneficial outcomes for five of the six categories examined: motor–reflex, cognitive–language, social–personal, physiological, and overall development. Labyak and Metzger (1997) examined nine studies that sought to measure the effect of effleurage back massage on physiological indicators of relaxation, and concluded that this form of MT was effective in promoting relaxation. However, interpretation of this finding is made problematic by their decision to include within-groups designs in the analysis, leaving open the possibility that the observed effects could be attributable to spontaneous recovery, placebo effect, or statistical regression (Field, 1998, p. 1270), and by the fact that only limited information is provided on the individual studies and their effect sizes. Ernst (1998) reviewed seven studies that assessed the effect of postexercise MT as a treatment for delayed-onset muscle soreness, reaching the tentative conclusion that MT may be a promising treatment, a conclusion that is hampered, like that of Labyak and Metzger, by a lack of sufficient statistics reported in the review itself.

No study to date has quantitatively reviewed the range of commonly reported MT effects in physically mature individuals. The present study is intended to address this problem. By means of a more exhaustive literature search than those conducted in previous reviews, we seek to unite the spectrum of MT studies that appear in a range of scientific disciplines including psychology, medicine, nursing, and kinesiology. In addition, by limiting inclusion to studies that use a between-groups design with random assignment of participants, the present study more accurately measures MT's true effects than reviews that have included other designs that are open to bias and do not permit strong causal claims.

Overview of MT

In modern practice, MT is not a single technique, or even a single set of techniques. Rather, it is a broad heading for a range of approaches that share common characteristics, a fact that is evident in definitions provided by the AMTA. The AMTA defines *massage* as "manual soft tissue manipulation [that] includes holding, causing movement, and/or applying pressure to the body," and *massage therapy* as "a profession in which the practitioner applies manual techniques, and may apply adjunctive therapies, with the intention of positively affecting the health and well-being of the client" (AMTA, 1999a). Clearly, these definitions provide latitude for a variety of approaches to exist under the rubric of MT. In one instance, MT may consist of a treatment lasting an hour or more, with long, firm strokes applied to numerous sites of the client's body, while that client lies partially disrobed on a specially designed table in a private clinic. In another instance, an MT client may receive a 10-min treatment of kneading focused on the shoulders while seated fully clothed in a specially designed chair, in a public space such as a shopping mall or workplace. Duration of treatment, types of touch and strokes administered, the sites of the body where treatment is applied, the apparatus used to facilitate treatment, and where that treatment takes place can all vary considerably. In addition, there is also considerable variability in the explanatory mechanisms that massage therapists (and recipients) subscribe to. Finally, the outcomes being pursued may vary widely; whereas one client may undergo MT in the hopes of obtaining relief from backache, another may receive MT to reduce emotional tension. In the present study, we define MT as the manual manipulation of soft tissue intended to promote health and well-being, a definition that encompasses the diverse nature of this form of treatment.

Though MT can take a variety of forms, the common element that allows these forms to be grouped together is their use of interpersonal touch in the form of soft tissue manipulation. This element forms the basis for the predominant theories encountered in MT research that are concerned with how it may provide the benefits of reductions in anxiety, depression, stress hormones, and pain. In several of these theories, the pressure applied to the body by means of MT is thought to trigger certain physiological responses that ultimately result in beneficial outcomes. It should be noted, however, that the pressure required by these theories has not been quantified, nor do existing clinical studies of MT routinely report on the amount of pressure administered in a way that would permit precise replication. Although at least one study utilizing infants as subjects observed differential effects in terms of weight gain for firm versus light strokes (Scafidi et al., 1986), no study to date has examined pressure as an independent variable with a sample of physically mature participants.

MT Theories

Unfortunately, there has been little emphasis on theory in the MT literature, with many researchers choosing to emphasize their predictions and results without testing, or in some cases even discussing, possible explanatory mechanisms. In other instances, theories are offered, but important details are omitted. Researchers have rarely specified such things as whether a theory explains immediate versus lasting effects, or if activation of a theoretical mechanism requires a course of treatment as opposed to a single application. For the theories that follow, we suggest that only the first one, the gate control theory of pain reduction, is logically limited to providing an immediate effect. Each of the remaining theories, to various degrees, could potentially offer immediate or lasting effects, or provide benefits that accumulate over a course of treatment. However, it must be noted that these are strictly suppositions and have not yet been tested.

The order in which these theories are presented reflects their frequency in the literature. Those that appear first are most frequently cited.

Gate Control Theory of Pain Reduction

Melzack and Wall (1965) theorized that the experience of pain can be reduced by competing stimuli such as pressure or cold, because of the fact that these stimuli travel along faster nervous system pathways than pain. In this way, MT performed with sufficient pressure would create a stimulus that interferes with the transmission of the pain stimuli to the brain, effectively "closing the gate" to the reception of pain before it can be processed (e.g., Barbour, McGuire, & Kirchhoff, 1986; Field, 1998; Malkin, 1994). This notion, that MT may have an analgesic effect consistent with gate control theory, appears in the literature more than any other theory pertaining to MT.

Promotion of Parasympathetic Activity

MT may provide its benefits by shifting the autonomic nervous system (ANS) from a state of sympathetic response to a state of parasympathetic response. A sympathetic response of the ANS occurs as an individual's body prepares to mobilize or defend itself when faced with a threat or challenge, and is associated with increased cardiovascular activity, an increase in stress hormones, and feelings of tension. Conversely, the parasympathetic response occurs when an individual's body is at rest and not faced with a threat, or is recovering from a threat that has since passed, and is associated with decreased cardiovascular activity, a decrease in stress hormones, and feelings of calmness and well-being (Sarafino, 2002, p. 40).

The pressure applied during MT may stimulate vagal activity (Field, 1998, pp. 1273, 1276–1277), which in turn leads to a reduction of stress hormones and physiological arousal, and a subsequent parasympathetic response of the ANS (e.g., Ferrell-Torry & Glick, 1993; Hulme, Waterman, & Hillier, 1999; Schachner, Field, Hernandez-Reif, Duarte, & Krasnegor, 1998). By stimulating a parasympathetic response through physiological means, MT may promote reductions in anxiety, depression, and pain that are consistent with a state of calmness. This same mechanism may also be responsible for several condition-specific benefits resulting from MT, such as increased immune system response in HIV-positive individuals (Diego et al., 2001), or improved functioning during a test of mental performance, in which study participants receiving MT also displayed changes in electroencephalograph pattern consistent with increased relaxation and alertness (Field, Ironson, et al., 1996). However, support for this theory is not universal, and it has even been suggested that MT may promote a sympathetic response of the ANS (e.g., Barr & Taslitz, 1970).

Influence on Body Chemistry

Two studies have linked MT with increased levels of serotonin (Field, Grizzle, Scafidi, & Schanberg, 1996; Ironson et al., 1996), which "may inhibit the transmission of noxious nerve signals to the brain" (Field, 1998, p. 1274). Others have suggested that manipulations such as rubbing, or applying pressure, may stimulate a release of endorphins into the bloodstream (Andersson & Lundeberg, 1995; Oumeish, 1998). In these ways, MT may provide pain relief or feelings of well-being by influencing the body chemistry of the recipient.

Mechanical Effects

Articles concerned with sports performance, exercise recovery, and injury management highlight the possibility that MT may speed healing and reduce pain by mechanical means. The manipulations and pressure of MT may break down subcutaneous adhesions and prevent fibrosis (Donnelly & Wilton, 2002, p. 5) and promote circulation of blood and lymph (Fritz, 2000, pp. 475–478), processes that may lead to reductions in pain associated with injury or strenuous exercise. However, as a group, studies concerned with measuring MT's effect on circulation have generated inconsistent results (Tiidus, 1999).

Promotion of Restorative Sleep

Individuals deprived of deep sleep may experience changes in body chemistry that lead to increases in pain. In the absence of deep sleep, levels of substance P increase and levels of somatostatin decrease, and both of these changes have been linked with the experience of pain (Sunshine et al., 1996). Sunshine et al. (1996) concluded that MT may have promoted deeper, less disturbed sleep in a sample of fibromyalgia sufferers who experienced a reduction in pain during the course of treatment. Chen, Lin, Wu, and Lin (1999) reached the conclusion that acupressure treatment may have been effective in improving sleep quality in a sample of elderly residents at an assisted-living facility. In this way, MT may reduce pain indirectly by promoting restorative sleep.

Interpersonal Attention

The five theories previously described, the majority of which attempt to explain the role MT may play in reducing pain, are the only ones that appear consistently in the scientific literature. However, the element of interpersonal attention that may be present in MT must also be considered. It is occasionally noted that some portion of MT effects may result from the interpersonal attention that the recipient experiences, as opposed to resulting entirely from the activation of physiological mechanisms (Field, 1998, p. 1270; Malkin, 1994). However, although this possible effect of interpersonal attention is acknowledged in the research literature, it is almost universally treated as a nuisance variable, and comparison treatments are selected in such a way that different groups receive the same amount of attention. In this way it is believed that any benefits demonstrated by the MT group that exceed those of the comparison group can be attributed to a specific ingredient of MT, specifically interpersonal touch in the form of soft tissue manipulation. Although many studies, including all of those in the present analysis, attempt to control for interpersonal attention, no study to date has examined it as an independent variable. As such, the role that interpersonal attention may play in MT effects is not well understood.

Effects

The present study examines both psychological and physiological effects resulting from MT. The psychological effects correspond with those suggested by Field and Gordon and endorsed by the AMTA, and are also of interest because MT can be considered a novel way of treating these conditions, which are more routinely addressed by means of psychotherapy or pharmaceuticals. The physiological effects nominate themselves because MT is a physical therapy.

We contend that MT effects can also be divided into single-dose effects and multiple-dose effects. Single-dose effects include MT's influence on states, either psychological or physiological, that are transient in nature and that might reasonably be expected to be influenced by a single session of MT. These include state anxiety, negative mood, pain assessed immediately following treatment, heart rate, blood pressure, and cortisol level. Multiple-dose effects are restricted to MT's influence on variables that are typically considered to be more enduring, or that would likely be influenced only by a series of MT sessions performed over a period of time, as opposed to a single dose. These variables include trait anxiety and depression, as well as pain when it is assessed at a time considerably after treatment has ended.

Frequently, researchers elect to examine both single-dose effects and multiple-dose effects within the same study. Diego et al. (2001) is one such study, in which treatment group participants received MT twice weekly for a period of 12 weeks, and comparison group participants engaged in progressive muscle relaxation (PMR) according to the same schedule. Assessments of state anxiety were made immediately prior to, and immediately following, both the first and last sessions of MT or PMR in the study. Depression, a condition expected to be more resistant to change, was assessed prior to the first session of MT or PMR, and not again until after the 24th and last sessions of either treatment. Many studies, particularly those conducted by the Touch Research Institute, use such a design in order to examine both single- and multiple-dose effects.

It must be noted that the terms *single-dose effect* and *multiple-dose effect* are not yet in common usage. Research into MT generated by the Touch Research Institute typically uses the terms *short-term effect* and *long-term effect* to make a similar distinction, but no consistent terminology has been used among other MT researchers. The decision to use this terminology is motivated by the desire to prevent any confusion that may arise with regard to how long an effect may last following the termination of treatment. Very few studies have attempted to examine whether any MT effects may last beyond the final day on which a participant receives treatment, making the use of the term *long-term effect* potentially confusing. All effects in the present study, with the exception of one outcome variable, were assessed on the same day that a treatment took place. The exception is MT's effect on delayed assessment of pain, for which assessments took place at various time periods significantly after treatment had been discontinued. Presently, pain appears to be the only variable in the MT literature that has been assessed in this way; the possibility that MT may have enduring effects on other variables has gone essentially unaddressed.

Single-Dose Effects

State anxiety. *State anxiety* is a momentary emotional reaction consisting of apprehension, tension, worry, and heightened ANS activity. Because state anxiety can be understood as a reaction to one's condition or environment, the intensity and duration of such a state is determined by an individual's perception of a situation as threatening (Spielberger, 1972, p. 489). Many of the samples used in MT research are drawn from populations experiencing serious and chronic health problems that can lead to feelings of anxiety (Hughes, 1987; Popkin, Callies, Lentz, Cohen & Sutherland, 1988). If MT is effective in reducing state anxiety, it may be doubly valuable to such patient populations, in that it could both improve subjective well-being and promote physical health. In physically healthy populations, the improvement in subjective well-being alone may be the primary benefit of a reduction in state anxiety.

Negative mood. Some studies have examined the effect of MT on mood, which may be defined as "transient episodes of feeling or affect" (Watson, 2000, p. 4). Although the primary studies do not specify a model for mood, virtually all the studies appear to be concerned with MT's ability to bring about a reduction of negative affect rather than an increase in positive affect.

Pain. Several studies have examined MT's immediate effect on pain, the unpleasant emotional and sensory experience that is associated with actual or potential tissue damage (Merskey et al., 1979). The sources of pain in the primary studies are diverse, and include conditions such as headache (Hernandez-Reif, Dieter, Field, Swerdlow, & Diego, 1998), backache (Hernandez-Reif, Field, Krasnegor, & Theakston, 2001), and labor pain (Hemenway, 1993) among others.

Cortisol. Some MT studies have attempted to measure a change in participants' cortisol levels. Cortisol is a stress hormone associated with the sympathetic response of the ANS (Field, 1998). MT, a therapy commonly thought of as relaxing, is expected to reduce cortisol levels, a finding that would be consistent with facilitating a parasympathetic response of the ANS (e.g., Field et al., 1992; Ironson et al., 1996).

Blood pressure. A handful of studies have examined MT's effect on blood pressure. Although predictions are not always offered, most commonly MT is expected to reduce blood pressure consistent with a parasympathetic response of the ANS (Hernandez-Reif, Field, et al., 2000; Okvat, Oz, Ting, & Namerow, 2002).

Heart rate. A few studies examining MT have attempted to measure its physiological effects in terms of heart rate. Researchers have not always offered clear predictions for this variable (Barr & Taslitz, 1970), but in cases where a prediction is evident, most often a decrease in heart rate is predicted, consistent with a parasympathetic response of the ANS (Cottingham, Porges, & Richmond, 1988; Okvat et al., 2002). Nevertheless, some researchers have noted that the opposite effect could be observed in cases in which MT was a novel experience for research participants (Reed & Held, 1988, p. 1232).

Multiple-Dose Effects

Trait anxiety. Several studies have examined MT's potential to reduce *trait anxiety*, the "relatively stable individual differences in anxiety proneness as a personality trait" (Spielberger, 1972, p. 482). In contrast with the transient and situation-specific nature of state anxiety, trait anxiety is a dispositional, internalized proneness to be anxious (Phillips, Martin, & Meyers, 1972, p. 412). Persons with high levels of trait anxiety tend to perceive the world as more dangerous or threatening, and experience anxiety states more frequently and with greater intensity than those with lower levels of trait anxiety (Spielberger, 1972, p. 482).

Depression. Ingram and Siegle (2002) noted that, in the course of research, the concept of depression has been defined many different ways, including as a mood state, a symptom, a syndrome, a mood disorder, and a disease. In the current meta-analysis, studies included in this category have been chosen on the basis of their utilization of a measure believed to capture something beyond "ordinary unhappiness" or a "sad mood," symptoms that would more accurately belong to the previously discussed category of negative mood. Subclinical depression, likely the best description of the type of depression most often assessed in MT research, consists of the aforementioned symptoms combined with symptoms such as mild to moderate levels of motivational and cognitive deficits, vegetative signs, and disruptions in interpersonal relationships (Ingram & Siegle, 2002, p. 90).

Delayed assessment of pain. A few studies have assessed participants' experience of pain at one or more time points significantly after a course of treatment has ended. The majority of these studies have done so at intervals that range from a few days to 6 weeks (Cen, 2000; Dyson-Hudson, Shiflett, Kirshblum, Bowen, & Druin, 2001; Preyde, 2000; Shulman & Jones, 1996), although one study included an assessment that took place 42 weeks after treatment ended (Cherkin et al., 2001). Because of the small number of studies, and the range of times at which delayed assessments were made, it is not expected that the present study will be able to determine precisely how long an analgesic effect resulting from MT lasts, or the rate at which such an effect decays; rather, the aim is simply to examine whether or not MT may have a lasting analgesic effect.

Moderators

A number of potentially interesting moderator variables have gone unexamined in MT research. Primary studies, for instance, have neglected to examine whether the length of MT sessions, or characteristics of the therapist and the recipient, influence the magnitude of MT effects. Similarly, only a few studies have used more than one comparison group, making it difficult to determine whether the type of treatment to which MT is compared may moderate its effects. Although within-study examinations of such moderators would permit stronger inferences to be made, their importance can be explored in the present study by means of between-study comparisons. In addition, the present study also examines a potential moderator that cannot be examined within an individual study, that of a laboratory effect.

Minutes of MT per session. It is common for treatment studies in medicine (e.g., Bollini, Pampallona, Tibaldi, Kupelnick, & Munizza, 1999; Yyldyz & Sachs, 2001) and in psychotherapy (e.g., Bierenbaum, Nichols, & Schwartz, 1976; Turner, Valtierra, Talken, Miller, & DeAnda, 1996) to examine dosage as an independent variable. However, no studies concerned with MT have done so. It is not known whether there is a minimal amount, in terms of minutes of MT administered per session, required to produce benefits, nor is it known whether there is an optimal amount of MT that produces benefits most efficiently. Fortunately, the studies that exist vary considerably in the amount of MT administered to participants in each session, from as little as 5 min (Fraser & Kerr, 1993; Wendler, 1999) to as much as an hour (Levin, 1990). By examining the relationship between the magnitude of effects generated and the amount of MT administered per session, the present study aims to determine whether there are minimum or optimum dosages of MT.

Mean age of participants. Although MT research has been performed on samples with a variety of age ranges, no study has sought to determine whether MT offers effects of differing magnitude to participants who differ in age. The present study examines whether there is a relationship between the mean age of the participants in a study and the magnitude of effects.

Gender of participants. Only one study to date, using a very small sample, has examined whether MT effects might vary according to the gender of the recipients (Weinrich & Weinrich, 1990). The present study more powerfully examines the possibility that the gender of the recipient might moderate MT effects by examining whether study outcomes vary according to gender.

Type of comparison treatment. In discussing the research findings for a different treatment modality (psychotherapy), Wampold (2001) noted that there is a distinction that must be made between absolute and relative efficacy. *Absolute efficacy* "refers to the effects of treatment vis-à-vis no treatment and accordingly is best addressed by a research design where treated participants are contrasted with untreated participants" (Wampold, 2001, p. 59). By contrast, *relative efficacy* "is typically investigated by comparing the outcomes of two treatments" when one wishes to determine which, if either, is superior (Wampold, 2001, p. 73). Clearly, the type of efficacy one wishes to measure plays an important part in determining what will be an appropriate choice for a comparison, as a study designed to measure one does not necessarily measure the other. This issue of distinguishing absolute efficacy (does MT work better than no treatment at all?) from relative efficacy (does MT work better than a specific alternative treatment, such as PMR?) has not been made explicit enough in MT research. However, a wide variety of comparison treatments have been used in MT research, some of which resemble a wait-list (no treatment) condition, whereas others use active treatments (such as the aforementioned PMR, or chiropractic care) as a point of comparison, or placebo-type comparison treatments that are meant to account for the effect of receiving attention (such as transcutaneous electrical stimulation performed with a machine that is not delivering any current to the participant). Logically, if MT has any effect whatsoever, we expect the MT effects that result from comparison with a no-treatment condition would be larger than those that result from comparing MT to any treatment condition, including so-called placebo conditions in which the participants receive no viable treatment. Combining the results of such different studies without attempting to account for these different comparison points could be problematic. For this reason, we have divided the comparison treatments in the primary studies, when possible, as belonging to either wait-list equivalent or active/placebo categories.

The wait-list equivalent category consists of comparison treatments that most closely resemble having received no treatment, and includes wait-list controls, standard care (in studies where all participants had a medical condition and continued to receive care for that condition regardless of group assignment), rest, reading, or a work break. The active/placebo category consists of all other comparison treatments, which are grouped according to the expectation that each could reasonably be expected to have some effect, including the possibility of a placebo effect. These include treatments such as PMR, acupuncture, chiropractic care, and various forms of attention, among others. Studies that used multiple comparison groups that could not be included together within a single category were not included in either category.

Therapist training. Treatment research in fields such as psychology (Pinquart & Soerensen, 2001; Weisz, Weiss, Alicke, & Klotz, 1987) and medicine (Lin et al., 1997; Tiemens et al., 1999) sometimes examines the existence of training effects to determine whether practitioners with greater amounts of training provide greater benefit to those being treated. No MT research, however, has examined the training of the massage therapist as an independent variable. However, the studies that do exist vary in regard to who performs MT on participants. The majority of studies use one or more fully trained and licensed massage therapists. Others utilize a layperson with only minimal training in providing massage, usually just enough to facilitate the study (e.g., Fischer, Bianculli, Sehdev, & Hediger, 2000; Weinrich & Weinrich, 1990; Wendler, 1999). By contrasting the results of studies that used a fully trained massage therapist with those that used a layperson to provide treatment, the present meta-analysis may be able to determine whether a therapist's training plays an important role in providing MT benefits.

Laboratory effect. Much of the research in this area, and especially the most recent research, is the product of a single laboratory, the Touch Research Institute (Field, 1998). Because this one source is responsible for a large proportion of MT studies, it is important to determine whether the results coming from this research group differ in a significant way from those of other researchers. If a difference is found, it would be important to examine more closely what factors contribute to that difference.

Predictions

MT is expected to promote significant and desirable reductions for each of the following variables, consistent with the existing explanatory theories outlined above: state anxiety, negative mood, pain (immediate and delayed assessment), cortisol, heart rate, blood pressure, trait anxiety, and depression. It is expected that greater reductions in these variables will be associated with higher doses of MT, in the form of minutes of MT administered per session, a relationship one would expect to observe if MT is a viable treatment. MT effects are not expected to vary according to the age or gender of participants. It is expected that MT effects generated from studies using wait-list equivalent comparison treatments will be larger than those generated from studies with active/placebo comparison treatments. Finally, no prediction is made concerning therapist training, or the existence of a laboratory effect.

Method

Literature Search and Criteria for Inclusion

A literature search was performed by Christopher A. Moyer and a graduate student in library and information sciences hired as a research assistant. The PsycINFO, MEDLINE, CINAHL, SPORT Discus, and *Dissertation Abstracts International* databases were searched using the following key words: *massage*, *massotherapy*, *acupressure* (and *accupressure*), *applied kinesiology*, *bodywork*, *musculoskeletal manipulation*, *reflexology*, *relaxation techniques*, *Rolfing*, *Touch Research Institute*, and *Trager*. Author searches were conducted within the same databases for the following authors associated with MT research: Burman, I.; Field, T.; Hart, S.; Hernandez-Reif, M.; Kuhn, C.; Peck, M.; Quintino, O.; Schanberg, S.; Taylor, S.; Theakston, H.; Weinrich, M.; and Weinrich, S. The Internet Web sites of the AMTA (www.amtamassage.org), the AMTA Foundation (www.amtafoundation.org), and the Touch Research Institute (http://www.miami.edu/touch-research/) were inspected for references, and the Touch Research Institute was also contacted directly to request unpublished data. The reference lists of all studies located by these means were then manually searched to yield additional studies.

All studies were inspected to ensure that they examined a form of MT consistent with the present study's operational definition, in which MT is defined as the manual manipulation of soft tissue intended to promote health and well-being. Studies were limited to those that administered MT to human participants other than infants, and that reported results in English. Studies concerned with chiropractic, heat therapy, hydrotherapy, passive motion, or progressive relaxation treatments were not included, unless the study also included an MT group. Studies examining therapeutic touch, a nursing intervention distinct from MT (in that it does not actually require physical contact to occur), were also excluded unless they also had an MT group. Several studies used more than two groups; in these cases, study results were combined in order to yield a between-groups comparison of all subjects receiving MT versus all subjects receiving non-MT treatments. Studies concerned with ice massage, participants performing self-massage, or massage performed with the aid of mechanical devices were excluded, as were studies that only included MT as part of a combination treatment (e.g., MT combined with exercise and movement therapy). MT administered with scented oil or MT administered with background music were not considered to be combination treatments, as these are common elements of MT in clinical practice, and studies using such treatment were included. Studies that did not explicitly label a treatment as "massage" or as "massage therapy," but used a treatment that fit the authors' operational definition of MT, were included.

These criteria yielded 144 studies concerned with outcomes of MT. Each study was reviewed independently by Christopher A. Moyer and James Rounds for possible inclusion in the meta-analysis. Studies were examined to ensure that they (a) compared an MT group with one or more non-MT control groups, (b) used random assignment to groups, and (c) reported sufficient data for a between-groups effect size to be generated on at least one dependent variable of interest. These three criteria accounted for approximately equal proportions of excluded studies.

The first two inclusion criteria were necessary to ensure that effects were a result of treatment. When participants in MT research serve as their own controls (e.g., Bauer & Dracup, 1987; Fakouri & Jones, 1987) there is no way to know whether effects are attributable to treatment or are instead the result of spontaneous recovery, placebo effect, or statistical regression (Field, 1998, p. 1270). Similarly, random assignment of participants to groups is necessary to control for the possibility of selection effects. Glaser

(1990) is an example of a study that is threatened in this way. Because treatment participants were previously enrolled in an MT program, and were compared with a group of participants who were not enrolled, it is likely that these groups differed in their predisposition toward MT in a way that could affect results.

When studies met all criteria apart from reporting sufficient data for calculating between-groups effects, and contact information was available, study authors were contacted in an attempt to obtain the necessary data. Specifically, there were seven studies from the Touch Research Institute for which this was the case (Field et al., 1999; Field et al., 2000; Field, Peck, et al., 1998; Field, Quintino, Henteleff, Wells-Keife, & Delvecchio-Feinberg, 1997; Field, Schanberg, et al., 1998; Field, Sunshine, et al., 1997; Sunshine et al., 1996). Upon our request, we were informed that the data needed from these studies (standard deviations) were no longer available. For this reason, these studies could not be included in the meta-analysis.

Interrater agreement for the inclusion process was 93%. The 10 studies for which there was initial disagreement, which occurred most frequently as a result of uncertainty regarding random assignment, were then reviewed jointly, with the subsequent decision made to exclude 8 of these. This resulted in a total of 37 studies meeting the inclusion criteria.

Variables and Measures

The nine variables for which effect sizes were calculated, and the instruments used to assess them, are as follows:

State anxiety. Fifteen of the 21 studies examining MT's effect on anxiety used the state anxiety portion of the State–Trait Anxiety Inventory (Spielberger, 1983). Five studies used a visual analogue scale, and one study used an investigator-constructed measure.

Negative mood. Seven of eight studies assessing negative mood used the Profile of Mood States (McNair, Lorr, & Droppleman, 1971). The remaining study used a visual analogue scale.

Immediate assessment of pain. Eight of the 15 studies assessing pain immediately following treatment used visual analogue scales alone. Two studies used a visual analogue scale in conjunction with either the Short-Form McGill Pain Questionnaire (Melzack, 1987) or the Menstrual Distress Questionnaire (Moos, 1968). Two studies used investigator-constructed measures, and the remaining studies relied on the Neck Pain Questionnaire (Leak et al., 1994), the revised Oswestry Low Back Pain Questionnaire (Hudson-Cook, Tomes-Nicholson, & Breen, 1989), or behavioral observation.

Cortisol. Of the seven studies that assessed cortisol levels, four relied on salivary samples, two on urinary samples, and one on a blood sample. In each case, samples were collected 20 min after the application of MT, to account for the fact that bodily cortisol levels are indicative of responses occurring 20 min prior to sampling (Field, Hernandez-Reif, Quintino, Schanberg, & Kuhn, 1998, p. 233).

Blood pressure. Five studies offer data pertaining to participants' blood pressure, assessed by means of a sphygmomanometer. Measures of diastolic and systolic blood pressure were combined into one effect size, because only a few studies report on this variable, and differ in regard to which values they report.

Heart rate. Of the six studies that assessed the effect of MT on heart rate, four used some type of automatic monitoring device, and one study indicated that pulse was assessed manually. One study did not specify the means by which heart rate was assessed.

Trait anxiety. Three studies of the seven assessing trait anxiety used the Symptom Checklist-90–Revised (SCL-90-R; Derogatis, 1983). One study combined the Conners Teacher Rating Scale (Conners, 1969) and the Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1985). The three remaining studies used either the Beck Anxiety Inventory (Beck, Brown, Epstein, & Steer, 1988), the trait portion of the State–Trait Anxiety Inventory (Spielberger, 1983), or an investigator-constructed measure.

Depression. Five of the 10 studies assessing depression utilized the Center for Epidemiological Studies—Depression Scale (CES–D; Radloff, 1977). Two used the SCL-90-R, and one combined the CES–D and the SCL-90-R. The remaining studies used either the Children's Depression Inventory—Short Form (Kovacs, 1992) or an investigator-constructed measure.

Delayed assessment of pain. The five studies assessing pain at a time significantly after treatment ended relied on five different instruments. These were the Neck Pain Questionnaire (Leak et al., 1994), the Wheelchair User's Shoulder Pain Index (Curtis et al., 1995), the McGill Pain Questionnaire (Melzack, 1975), a visual analogue scale, and an investigator-constructed measure.

Statistical Analysis

Effect sizes. Between-groups comparisons on variables of interest were converted to Hedges's g effect size. Hedges's g, calculated as (Group Mean 1 – Group Mean 2) ÷ pooled standard deviation, estimates the number of standard deviations by which the average member of a treatment group differs from the average member of a comparison group for a given outcome. In cases where a study used more than one measure to examine the same outcome variable, results of multiple measures were standardized and then averaged in order to result in one effect size per variable for any study. Similarly, if a study examined the immediate effects of more than one application of treatment, or examined the treatment effect on delayed assessments of pain at more than one time point, the results of the multiple applications or assessments were standardized and then averaged in order to calculate a single effect size for that study. Effect sizes were coded such that positive values, for any variable, indicate a more desirable outcome (e.g., a reduction in anxiety) for the participants who received MT.

This process was done independently by both the first and second authors for the entire set of effect sizes; these initial results were then compared in order to determine agreement and eliminate errors. Agreement rate (*AR*) of initial calculations for the entire set of 84 effect sizes was 88%. Within outcome categories, the initial rates of agreement were as follows: state anxiety, $AR = 86\%$ ($n = 21$); negative mood, $AR = 88\%$ ($n = 8$); immediate assessment of pain, $AR = 87\%$ ($n = 15$); cortisol, $AR = 86\%$ ($n = 7$); blood pressure, $AR = 60\%$ ($n = 5$); heart rate, $AR = 100\%$ ($n = 6$); trait anxiety, $AR = 86\%$ ($n = 7$); depression, $AR = 90\%$ ($n = 10$); and delayed assessment of pain, $AR = 60\%$ ($n = 5$). When discrepancies were observed, calculations were reviewed jointly to correct errors, and a consensus was reached.

Individual study effect sizes were then subjected to a correction for small sample bias, then weighted by their inverse variance and averaged to generate a mean effect size for each outcome variable (Lipsey & Wilson, 2001). An overall, nonspecific effect size was also calculated by averaging all effects within each study, and then calculating a weighted overall effect from these effect sizes. All effect sizes were calculated according to a random effects model of error estimation.

Statistical significance of the mean effect sizes was assessed by calculating the 95% confidence interval (CI) for the population parameter. A significance level of .05 or better is inferred when zero is not contained within the CI. For effect sizes reaching statistical significance, the likelihood and possible influence of publication bias—the possibility that studies retrieved for the meta-analysis may not be a random sample of all studies actually conducted (Rosenthal, 1998)—was assessed by means of a trim and fill procedure (Duval & Tweedie, 2000), a nonparametric statistical technique of examining the symmetry and distribution of effect sizes plotted by inverse variance. This technique first estimates the number of studies that may be missing as a result of publication bias, and then allows a new, attenuated effect size to be calculated on the basis of the influence such studies would have if they were included in the analysis. The trim and fill procedure was performed with the Division of Vector-Borne Infectious Diseases library using the statistical computing program S-PLUS (Bigger-

Table 1
Individual Study Characteristics and Effect Sizes (g) by Outcome Variable

Study	Participants	*N*	% female	Mean age	Min/ session	Comp. type	Trained therapist?	TRI study?	*g*
				State anxiety					
Chang et al. (2002)	Pregnant women	60	100	28	30	WL	No	No	0.45
Chin (1999)	Surgery patients	85	100	42	10	WL	No	No	−0.50
Delaney et al. (2002)	Healthy adults	30	53	31	20	WL	Yes	No	0.20
Diego et al. (2002)	Spinal cord patients	20	25	39	40	A/P	Yes	Yes	0.57
Diego et al. (2001)	HIV+ adolescents	24	92	17	20	A/P	Yes	Yes	0.87
Field et al. (2002)	Fibromyalgia patients	20	—	51	30	A/P	Yes	Yes	0.11
Field, Ironson, et al. (1996)	Medical staff	50	80	26	15	A/P	Yes	Yes	0.48
Fischer et al. (2000)	Amniocentesis patients	200	100	34	—	WL	No	No	0.00
Fraser & Kerr (1993)	Institutionalized elderly	21	—	—	5	C	—	No	1.20
Groer et al. (1994)	Healthy adults	32	69	64	10	WL	No	No	−0.21
Hernandez-Reif, Field, et al. (1998)	Multiple sclerosis patients	24	75	48	45	WL	Yes	Yes	1.33
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	0.07
Hernandez-Reif, Field, et al. (2000)	Hypertensive adults	30	53	52	30	A/P	Yes	Yes	0.24
Hernandez-Reif, Martinez, et al. (2000)	PDD patients	22	100	33	30	A/P	Yes	Yes	0.84
Leivadi et al. (1999)	University dance students	30	100	20	30	A/P	Yes	Yes	0.21
Levin (1990)	Healthy adults	36	—	27	60	WL	Yes	No	1.30
Menard (1995)	Surgery patients	30	100	52	45	WL	Yes	No	1.12
Mueller Hinze (1988)	Healthy women	48	100	27	10	C	—	No	0.50
Okvat et al. (2002)	Cardiac catheter patients	78	24	61	10	A/P	Yes	No	−0.06
Richards (1993)	Hospitalized elderly men	69	0	66	6	C	No	No	0.80
Wendler (1999)	Soldiers	93	10	30	5	A/P	No	No	0.54
				Negative mood					
Abrams (1999)	Children/adolescents with ADHD	30	17	13	20	WL	Yes	Yes	0.09
Field et al. (2002)	Fibromyalgia patients	20	—	51	30	A/P	Yes	Yes	0.00
Field, Ironson, et al. (1996)	Medical staff	50	80	26	15	A/P	Yes	Yes	1.09
Hernandez-Reif, Field, et al. (1998)	Multiple sclerosis patients	24	75	48	45	WL	Yes	Yes	0.32
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	−0.07
Hernandez-Reif, Martinez, et al. (2000)	PDD patients	24	100	33	30	A/P	—	Yes	1.27
Leivadi et al. (1999)	University dance students	30	100	20	30	A/P	Yes	Yes	−0.49
Levin (1990)	Healthy adults	36	—	27	60	WL	Yes	No	0.46
				Immediate assessment of pain					
Cen (2000)	Neck pain patients	31	75	48	30	C	Yes	No	1.21
Chang et al. (2002)	Pregnant women	60	100	28	30	WL	No	No	0.99
Chin (1999)	Surgery patients	85	100	42	10	WL	No	No	−0.30
Field et al. (2002)	Fibromyalgia patients	20	—	51	30	A/P	Yes	Yes	0.85
Fischer et al. (2000)	Amniocentesis patients	200	100	34	—	WL	No	No	−0.13
Hemenway (1993)	Labor pain patients	32	100	23	10	A/P	No	No	0.38
Hernandez-Reif, Dieter, et al. (1998)	Headache patients	26	—	40	30	WL	Yes	Yes	0.52
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	0.35
Hernandez-Reif, Martinez, et al. (2000)	PDD patients	24	100	33	30	A/P	—	Yes	0.81
Hsieh et al. (1992)	Back pain patients	63	—	34	—	A/P	Yes	No	−0.94
Leivadi et al. (1999)	University dance students	30	100	20	30	A/P	Yes	Yes	0.21
Mueller Hinze (1988)	Healthy women	48	100	27	10	C	—	No	0.81
Okvat et al. (2002)	Cardiac catheter patients	78	24	61	10	A/P	Yes	No	0.16
Weinrich & Weinrich (1990)	Cancer patients	28	36	62	10	A/P	No	No	−0.04
Wilkie et al. (2000)	Hospice care cancer patients	29	31	63	30	WL	Yes	No	−0.14
				Cortisol					
Abrams (1999)	Children/adolescents with ADHD	30	17	13	20	WL	Yes	Yes	0.07
Chin (1999)	Surgery patients	85	100	42	10	WL	No	No	0.07
Field, Ironson, et al. (1996)	Medical staff	50	80	26	15	A/P	Yes	Yes	0.45
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	−0.39
Hernandez-Reif, Field, et al. (2000)	Hypertensive adults	30	53	52	30	A/P	Yes	Yes	0.18
Hernandez-Reif et al. (2002)	Parkinson's disease patients	16	50	58	30	A/P	Yes	Yes	0.41
Leivadi et al. (1999)	University dance students	30	100	20	30	A/P	Yes	Yes	0.13

Table 1 (*continued*)

Study	Participants	*N*	% female	Mean age	Min/ session	Comp. type	Trained therapist?	TRI study?	*g*
				Blood pressure					
Delaney et al. (2002)	Healthy adults	30	53	31	20	WL	Yes	No	−0.06
Hernandez-Reif, Field, et al. (2000)	Hypertensive adults	30	53	52	30	A/P	Yes	Yes	0.29
Mueller Hinze (1988)	Healthy women	48	100	27	10	C	—	No	0.49
Okvat et al. (2002)	Cardiac catheter patients	78	24	61	10	A/P	Yes	No	0.16
Wendler (1999)	Soldiers	93	10	30	5	A/P	No	No	0.34
				Heart rate					
Cottingham et al. (1988)	Healthy men	32	0	27	45	WL	Yes	No	0.22
Delaney et al. (2002)	Healthy adults	30	53	31	20	WL	Yes	No	0.53
Mueller Hinze (1988)	Healthy women	48	100	27	10	C	—	No	0.82
Okvat et al. (2002)	Cardiac catheter patients	78	24	61	10	A/P	Yes	No	0.16
Richards (1993)	Hospitalized elderly men	69	0	66	6	C	No	No	0.35
Wendler (1999)	Soldiers	93	10	30	5	A/P	No	No	0.52
				Trait anxiety					
Abrams (1999)	Children/adolescents with ADHD	30	17	13	20	WL	Yes	Yes	0.94
Hernandez-Reif, Dieter, et al. (1998)	Headache patients	26	—	40	30	A/P	Yes	Yes	0.52
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	0.98
Hernandez-Reif, Field, et al. (2000)	Hypertensive adults	30	53	52	30	A/P	Yes	Yes	2.11
Rexilius et al. (2002)	Patient caregivers	35	72	52	30	C	Yes	No	0.31
Scherder et al. (1998)	Alzheimer's patients	16	—	86	30	A/P	—	No	0.68
Shulman & Jones (1996)	Employees	33	61	40	15	WL	Yes	No	0.06
				Depression					
Abrams (1999)	Children/adolescents with ADHD	30	17	13	20	WL	Yes	Yes	0.29
Diego et al. (2002)	Spinal cord patients	20	25	39	40	A/P	Yes	Yes	0.32
Diego et al. (2001)	HIV+ adolescents	24	92	17	20	A/P	Yes	Yes	0.74
Field et al. (2002)	Fibromyalgia patients	20	—	51	30	A/P	Yes	Yes	0.63
Hernandez-Reif, Dieter, et al. (1998)	Headache patients	26	—	40	30	WL	Yes	Yes	0.38
Hernandez-Reif et al. (2001)	Back pain patients	24	54	40	30	A/P	Yes	Yes	0.80
Hernandez-Reif, Field, et al. (2000)	Hypertensive adults	30	53	52	30	A/P	Yes	Yes	0.82
Hernandez-Reif, Martinez, et al. (2000)	PDD patients	24	100	33	30	A/P	—	Yes	0.28
Rexilius et al. (2002)	Patient caregivers	35	72	52	30	C	Yes	No	0.91
Scherder et al. (1998)	Alzheimer's patients	16	—	86	30	A/P	—	No	1.50
				Delayed assessment of pain					
Cen (2000)	Neck pain patients	31	75	48	30	C	Yes	No	0.36
Cherkin et al. (2001)	Back pain patients	262	58	45	—	C	Yes	No	0.25
Dyson-Hudson et al. (2001)	Wheelchair users	18	22	45	45	A/P	Yes	No	0.35
Preyde (2000)	Back pain patients	73	51	45	30	C	Yes	No	0.49
Stratford et al. (1989)	Tendinitis patients	40	50	43	10	WL	—	No	0.30

Note. Dashes indicate that data were not reported. Comp. = comparison; TRI = Touch Research Institute; A/P = active/placebo; C = combination; WL = wait-list equivalent; PDD = premenstrual dysphoric disorder; ADHD = attention-deficit/hyperactivity disorder.

staff, 2000), which generates results for the three estimators of missing studies (L_0, R_0, and Q_0) described by Duval and Tweedie (2000). Per the suggestion of these authors, the number of missing studies resulting from each estimator was considered before the eventual decision was made to report results according to the L_0 and R_0 estimators, which are considered preferable for most situations (Duval & Tweedie, 2000).

Moderators. As with effect sizes, moderator variable data were also coded independently by both the first and second authors. Agreement rate for initial coding of all moderator data across categories was 97% (n = 158). Within moderator variable categories, initial agreement rates were as follows: minutes per session, AR = 100% (n = 34); mean age, AR = 100% (n = 25); comparison type, AR = 97% (n = 34); training, AR = 87% (n = 31); and laboratory effect, AR = 100% (n = 34); proportion of female participants was coded only by the first author. The influence of moderator variables was assessed by performing a weighted regression analysis (Lipsey & Wilson, 2001) on the set of overall, nonspecific effect sizes for all studies.

Results

Table 1 lists the effect sizes (Hedges's g) for each study by outcome variable, as well as important study characteristics. The 37 studies included in the meta-analysis used a total of 1,802 participants, including 795 who received MT. Of the 1,007 participants who received a comparison treatment, 49% received one of the five treatments categorized as wait-list equivalent, and the remaining 51% received a treatment categorized as active/placebo. The mean number of participants for a study was 48.7 (SD = 49.0), and mean age of all participants was 40.6 years (SD = 13.9). Participants received an average of 21.7 min (SD = 14.0) of MT per application of treatment. Sixty-five percent of studies reported using a trained massage therapist (or therapists), 22% reported using a minimally trained person (or persons) to deliver treatment, and 14% did not indicate the level of training of the person (or persons) administering MT. Thirty-two percent of studies were conducted by the Touch Research Institute.

Table 2 graphically represents the distribution of overall study effect sizes by means of a stem and leaf plot. Table 3 lists the mean effect size for each outcome variable, as well as the number of studies contributing to the effect size, its 95% CI, and the results of trim and fill procedures applied to statistically significant effects. The nonspecific, overall mean effect was statistically significant (g = 0.34, $p < .01$). Among the nine specific outcome variables examined, six displayed statistically significant effect sizes. For the single-dose effects category, these included state anxiety (g = 0.37, $p < .01$), blood pressure (g = 0.25, $p < .02$), and heart rate (g = 0.41, $p < .01$). Negative mood (g = 0.34), immediate assessment of pain (g = 0.28) and cortisol (g = 0.14) were nonsignificant. All outcome variables examined within the multiple-dose effects category, including trait anxiety (g = 0.75, $p < .01$), depression (g = 0.62, $p < .01$), and delayed assessment of pain (g = 0.31, $p < .01$), were statistically significant.

The results of trim and fill analyses conducted on the statistically significant outcome variables indicated that the results are fairly robust to the threat of publication bias. For overall effects, an analysis based on the L_0 estimator yielded 10 studies missing as a result of publication bias, which result in an attenuated but still significant effect (g = 0.20, 95% CI = 0.06, 0.34); the funnel plot of actual and filled study effect sizes for this analysis is represented in Figure 1. The same analysis performed with the R_0 estimator indicates no missing studies. Of the six specific outcome variables that generated significant effects, results of trim and fill analyses indicated that only state anxiety and delayed assessment of pain effects were likely overestimated due to publication bias. A trim and fill analysis performed on the state anxiety effect using the L_0 estimator yielded an estimate of four studies likely missing as a result of publication bias. When the influence such studies would have on state anxiety is calculated, the adjusted effect is nonsignificant (g = 0.22, 95% CI = −0.01, 0.45). A trim and fill analysis performed on the delayed assessment of pain outcome variable using the L_0 estimator yielded a slightly smaller but still significant effect (g = 0.26, 95% CI = 0.07, 0.44). When the same analyses were performed with the R_0 estimator, no missing studies were indicated in either case.

An analysis of potential moderator variables for the set of overall effect sizes was not statistically significant, $Q_R(6) = 5.80$. Despite the nonsignificance of the regression model, the decision was made to inspect the significance of the individual moderator variables. Minutes of MT administered per session (z = 1.55, p = .06, one-tailed) was the only moderator that approached the predetermined alpha for statistical significance ($p < .05$). To examine this variable a bit further, we calculated separate weighted effect sizes for two categories of studies. Studies that administered ≥ 30 min of MT per session generated an effect that was substantially larger than that resulting from the entire set of studies (g = 0.54, 95% CI = 0.32, 0.76). Studies that administered < 30 min of MT per session demonstrated an effect that was slightly smaller than that of the entire set of studies, but still significant (g = 0.30, 95% CI = 0.08, 0.52).

Table 2
Stem and Leaf Plot of 37 Overall Study Effect Sizes

Stem	Leaf
−0.9	4
−0.8	
−0.7	
−0.6	
−0.5	
−0.4	
−0.3	
−0.2	14
−0.1	4
−0.0	47
0.0	26
0.1	1
0.2	2259
0.3	0558
0.4	0114579
0.5	8
0.6	17
0.7	2389
0.8	013
0.9	
1.0	9
1.1	2
1.2	0

Discussion

This meta-analysis supports the general conclusion that MT is effective. Thirty-seven studies yielded a statistically significant overall effect as well as six specific effects out of nine that were examined. Significant results were found within the single-dose and multiple-dose categories, and for both physiological and psychological outcome variables. Confidence in these findings is bolstered by the results of trim and fill analyses, which indicate that the results are not unduly threatened by publication bias.

Single-Dose Effects

Three of the six single-dose effects examined were statistically significant. The magnitude of MT's effect on state anxiety means that the average participant receiving MT experienced a reduction of state anxiety that was greater than 64% of participants receiving a comparison treatment. MT was also more effective than comparison treatments in reducing blood pressure and heart rate. The average MT participant experienced a reduction in blood pressure that was greater than 60% of comparison group participants, whereas for heart rate, the reduction resulting from MT was greater than 66% of comparison group participants, findings that are

Table 3
Mean Effect Sizes (g) and Results of Trim and Fill Analyses by Outcome Variable

Outcome variable	k	g	95% CI	L_0	Adjusted g based on $k + L_0$	Adjusted 95% CI
Overall	37	0.34**	0.21, 0.48	10	0.20**	0.06, 0.34
Single-dose effects						
State anxiety	21	0.37**	0.14, 0.59	4	0.22	−0.01, 0.45
Negative mood	8	0.34	−0.08, 0.76	—		
Immediate pain	15	0.28	−0.01, 0.57	—		
Cortisol	7	0.14	−0.10, 0.38	—		
Blood pressure	5	0.25*	0.03, 0.48	0		
Heart rate	6	0.41**	0.19, 0.62	0		
Multiple-dose effects						
Trait anxiety	7	0.75**	0.27, 1.22	0		
Depression	10	0.62**	0.37, 0.88	0		
Delayed pain	5	0.31**	0.10, 0.52	3	0.26**	0.07, 0.44

Note. A positive g indicates a reduction for any outcome variable. Dashes indicate data not calculated because of nonsignificance of effect size. CI = confidence interval; L_0 = estimate of missing studies resulting from trim and fill procedure.
* $p < .05$. ** $p < .01$.

consistent with the theory that MT may promote a parasympathetic response of the ANS. Cortisol, however, another outcome variable that would be expected to decrease if MT promotes a parasympathetic response, was not significantly reduced, a finding that contrasts with the conclusion previously reached by Field (1998). Despite this inconsistent support for MT promoting a parasympathetic response, the significant finding for the cardiovascular variables suggests that future research should examine whether MT might have an enduring effect on blood pressure such that it could be used in treating hypertension.

MT did not exhibit an effect on immediate assessment of pain. This finding contrasts with the commonly offered notion that MT may provide analgesia by competing with painful stimuli in a way consistent with the gate control theory of pain. MT's effect on negative mood was also nonsignificant.

Multiple-Dose Effects

Some of MT's largest and most interesting effects belong to the multiple-dose effects category. Despite the fact that MT did not demonstrate an effect on immediate assessment of pain, a significant effect was found for delayed assessment of pain. MT participants who received a course of treatment and were assessed several days or weeks after treatment ended exhibited levels of

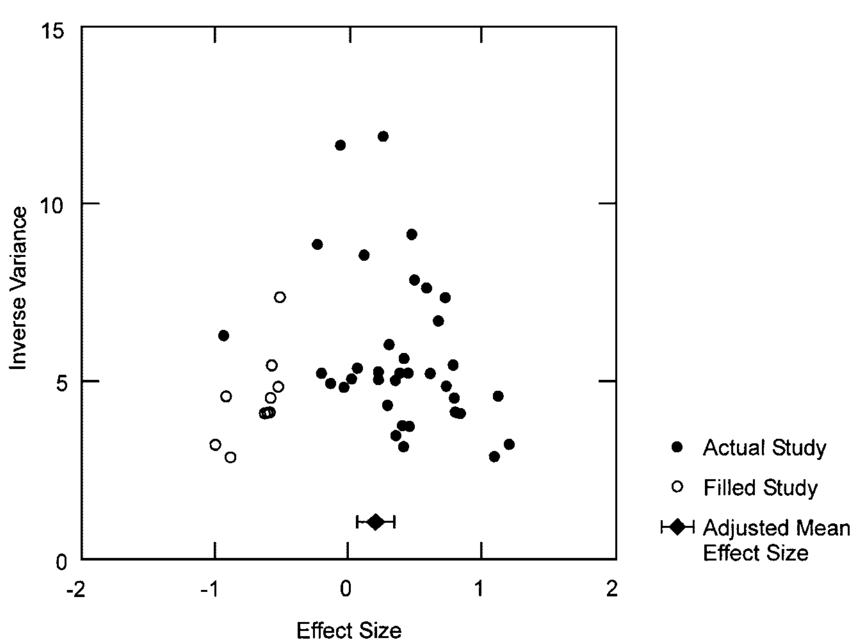

Figure 1. Funnel plot of 37 overall study effect sizes (g) plus the 10 effect sizes filled in by means of trim and fill procedure using the L_0 estimator; no filled studies are indicated using the R_0 estimator.

pain that were lower, on average, than 62% of comparison group participants. This finding is consistent with the theory that MT may promote pain reduction by facilitating restorative sleep, but without data on sleep patterns, this possibility is only conjecture.

Reductions of trait anxiety and depression following a course of treatment were MT's largest effects. The average MT participant experienced a reduction of trait anxiety that was greater than 77% of comparison group participants, and a reduction of depression that was greater than 73% of comparison group participants. These effects are similar in magnitude to those found in meta-analyses examining the absolute efficacy of psychotherapy, a more traditional treatment for either condition, in which it is estimated that the average psychotherapy client fares better than 79% of untreated clients (Wampold, 2001, p. 70). Considered together, these results indicate that MT may have an effect similar to that of psychotherapy.

Moderators

All six moderators that were examined were nonsignificant. In most cases, this was not surprising, given that we did not expect effects to vary according to recipient characteristics and made no predictions concerning therapist training or laboratory effect. However, it was unexpected that neither the minutes of MT administered per session nor type of comparison treatment moderated effects in a way that was statistically significant.

Minutes of MT administered per session was the only moderator that approached the predetermined alpha for statistical significance. This, combined with the logic that if MT has an effect, longer doses should likely be more potent, leads us to suspect that our analysis failed to find a relationship because of insufficient statistical power rather than the true absence of any moderating effect. Nevertheless, it must be concluded that this moderator may not be as important as we predicted, and that even short sessions of MT can be effective. Future studies could more powerfully examine the role of session length by including two levels of this variable, something that does not appear to have been done in any study to date.

Whether studies used a wait-list equivalent or active/placebo comparison group was not significant for overall effects. This finding does not support the prediction that studies using wait-list equivalent comparison treatments would yield larger effects. Because stronger inferences can be made from within-study comparisons, we decided to compare this result with those from studies that included both an active/placebo and a wait-list equivalent comparison group within the design. Three studies fitting this criterion examined state anxiety as an outcome. Richards (1993), in a study that involved 69 participants, found that wait-list participants improved significantly less than those who received a combination of muscle relaxation, mental imagery, and relaxing music. By contrast, Fraser and Kerr (1993), in a study that involved 21 participants, found no statistically significant difference in outcome between two comparison groups, one of which received attention in the form of conversation (active/placebo), the other of which received no intervention (wait-list equivalent). Similarly, Mueller Hinze (1988), in a study with 48 participants, found no differences in outcome for three comparison groups including therapeutic touch (active/placebo), transcutaneous electrical stimulation without current (active/placebo), and a no-treatment control (wait-list equivalent). As a group, these contrasting results seem to agree with the nonsignificant finding in the meta-analysis in suggesting that whether MT is compared with an active/placebo or wait-list equivalent treatment does not substantially influence effects. However, no primary studies that examined MT's largest effects—on depression and trait anxiety—used such a design; the influence of such a moderator may be more evident in relation to these more robust effects, and could be examined in future studies by using both types of comparison groups.

The prediction that effects would not vary according to the age or gender of participants was supported. Neither of these recipient characteristics was significantly associated with overall effects. Therapist training did not have a significant effect on outcome. This finding, however, should not be used to conclude that training is of no consequence. In the present meta-analysis, this variable could only be dummy coded according to whether a study involved a trained massage therapist, or a layperson trained by a massage therapist for the purposes of conducting the study. It was not possible to differentiate the levels of experience various massage therapists may have had, nor was it possible to know how much training laypersons involved in the studies had received. The only conclusion that can be definitively reached from this result is that laypersons provided with some training can provide beneficial MT, information that may be valuable to researchers working with limited resources. No evidence of a laboratory effect was found.

MT Theories

Mixed support for existing theories. It is interesting to note that, among the theories that are commonly offered to explain MT effects, the most popular theories are the ones least supported by the present results. The failure to find a significant effect for immediate assessment of pain contradicts the theory that MT provides stimuli that interfere with pain consistent with gate control theory. Reductions in blood pressure and heart rate resulting from MT do support the theory that MT promotes a parasympathetic response, although, if this theory is true, it would also be expected that a significant reduction in cortisol levels would have occurred, which did not. By contrast, the remaining theories are not inconsistent with the current results. MT's effects on state anxiety, trait anxiety, and depression may come about as a result of MT's influence on body chemistry, whereas the ability of a course of MT treatment to provide lasting pain relief may result from the mechanical promotion of circulation and breakdown of adhesions, or from improved sleep promoted by the treatment.

MT from a psychotherapy perspective. Another theory that has not previously been put forth may also account for MT effects. MT may provide benefit in a way that parallels the common-factors model of psychotherapy. Substantial evidence suggests that the considerable efficaciousness of psychotherapy results not from any specific ingredient of treatment, but rather from the factors that all forms of psychotherapy share (Wampold, 2001). In this model, factors such as a client who has positive expectations for treatment, a therapist who is warm and has positive regard for the client, and the development of an alliance between the therapist and client are considered to be more important than adherence to a specific modality of psychotherapy. The same model can be extended to MT, given the possibility that benefits arising from it may come about more from factors such as the recipient's attitude toward MT, the therapist's personal characteristics and expectations, and the interpersonal contact and communication that take place during treatment, as opposed to the specific form of MT used or the site to which it is applied.

Several of the findings in the present study are consistent with such a model applied to MT. The finding that MT has an effect on trait anxiety and depression that is similar in magnitude to what would be expected to result from psychotherapy suggests the possibility that these different treatments may be more similar than previously considered. Further support comes from the fact that MT training was not predictive of effects. Possibly, MT effects are more closely linked with characteristics of the massage provider that are independent of skill or experience in performing soft tissue manipulation.

In addition to having similar effects, MT parallels psychotherapy in structure. Both forms of therapy routinely rely on repeated, private interpersonal contact between two persons. Studies contributing effects to the trait anxiety and depression outcome categories used treatment protocols similar to those that might be maintained in short-term psychotherapy, with twice-weekly meetings over a span of 5 weeks being most common; other studies used similar protocols. Interestingly, the length of individual sessions in these studies ranged from 15 to 40 min, with 30 min being the most common session length. Had these studies used a session length equivalent to the "50-minute hour" that is routine in psychotherapy, it is possible that MT's effect for these variables would have matched or exceeded that expected of psychotherapy.

Application of such a psychotherapeutic, common-factors model to MT has important ramifications for future research. Different questions need to be asked, different moderators tested, and different comparisons made. Foremost among the questions is whether MT is as effective as psychotherapy. No study has directly compared these treatments, a comparison that would be justified given the finding that some MT effects may be very similar to those of psychotherapy. Similarly, it could be interesting to determine whether a combination of MT and psychotherapy could be significantly more effective than either alone. Another critical issue that needs to be examined is whether these specific MT effects are enduring. Current studies contributing to these effects all performed assessments on the final day of treatment, making it impossible to know if the effects last. Studies that administer a course of MT treatment should make assessments not only immediately after treatment has ended, but also several weeks or months later, to determine whether reductions of anxiety, depression, or other conditions are maintained.

Despite the fact that MT is a treatment that relies on interpersonal contact, no research has attempted to manipulate, or even measure, the kind of psychological interactions that undoubtedly take place between the provider and recipient of MT. Details worth examining include (a) the amount and types of communication, both verbal and nonverbal, that take place between massage therapist and recipient; (b) the recipient's and therapist's expectations for whether treatment will be beneficial; (c) the amount of empathy perceived by the recipient on behalf of the therapist; (d) whether the psychological state of the therapist is of importance; and (e) whether personality traits of the therapist, of the recipient, or any interaction between those personality traits influence outcomes. An examination of such personality, process, and therapeutic relationship variables may reveal that benefiting from MT is just as much about feeling valued as it is about being kneaded.

Finally, the possibility that MT may provide a significant portion of its benefit in a way that parallels psychotherapy has a bearing on the selection of comparison treatments used in future research. Viewed from a medical perspective, comparison treatments in MT research are thought to function as placebo treatments, in that they control for incidental aspects of the treatment (most notably attention in MT research) while withholding what is thought to be the specific effective ingredient (soft tissue manipulation). However, the same logic cannot be applied if the treatment being examined is thought to be beneficial because of incidental aspects, because the double-blind condition favored in medicine trials, where neither the participants nor the researchers involved in the study are aware of who is receiving viable treatment and who is receiving the placebo, is logically impossible (Wampold, 2001, p. 129). Those supervising and administering treatment in MT research, as in psychotherapy research, are aware of the treatment being delivered and know if it is intended to be therapeutic. This is a critical factor to consider if the treatment being studied relies on the therapist's beliefs and intentions in order to be effective. The placebo treatment, derived from medical trials intended to examine the effectiveness of specific ingredients, cannot control for the incidental aspects of a treatment such as MT. When a common-factors model is applied to MT, the notion that a comparison treatment such as progressive muscle relaxation controls for attention is incorrect. The attention provided to comparison group participants is identical in quantity but not in quality, and cannot be expected to function as a control for the attention received by participants in the MT treatment group.

The idea that MT has significant parallels with psychotherapy, and that perspectives gained from psychotherapeutic research should be applied to future research, is not meant to suggest that MT delivers effects entirely by psychological means. Clearly MT is at least partially a physical therapy, and some of its benefits almost certainly occur through physiological mechanisms. In fact, one of the most interesting aspects of MT is that it may deliver benefit in multiple ways; specific ingredients and common factors may each play a role, with each being differentially important depending on the desired effect. However, whether researchers wish to study MT as a physical therapy, as a psychological one, or as both, new research should examine not merely the effects resulting from MT, but also the ways in which these effects come about. It is only by testing MT theories that a better understanding of this ancient practice will result.

References

References marked with an asterisk indicate studies included in the meta-analysis.

*Abrams, S. M. (1999). Attention-deficit/hyperactivity disordered children and adolescents benefit from massage therapy (Doctoral dissertation, University of Miami, 1999). *Dissertation Abstracts International, 60,* 5218.

American Massage Therapy Association. (1999a). AMTA definition of massage therapy. Retrieved April 6, 2003, from http://www.amtamassage.org/about/definition.html

American Massage Therapy Association. (1999b). Enhancing your health with therapeutic massage. Retrieved April 6, 2003, from http://www.amtamassage.org/publications/enhancing-health.htm

Andersson, S., & Lundeberg, T. (1995). Acupuncture—From empiricism to science: Functional background to acupuncture effects in pain and disease. *Medical Hypotheses, 45,* 271–281.

Barbour, L. A., McGuire, D. B., & Kirchhoff, K. T. (1986). Nonanalgesic methods of pain control used by cancer outpatients. *Oncology Nursing Forum, 13,* 56–60.

Barr, J. S., & Taslitz, N. (1970). The influence of back massage on autonomic functions. *Physical Therapy, 50,* 1679–1691.

Bauer, W. C., & Dracup, K. A. (1987). Physiologic effect of back massage in patients with acute myocardial infarction. *Focus on Critical Care, 14,* 42–46.

Beck, A., Brown, G., Epstein, N., & Steer, R. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56,* 893–897.

Bierenbaum, H., Nichols, M. P., & Schwartz, A. J. (1976). Effects of varying session length and frequency in brief emotive psychotherapy. *Journal of Consulting and Clinical Psychology, 44,* 790–798.

Biggerstaff, B. (2000). S-Plus library DVBID (dvbidlib.exe) [Computer software]. Retrieved from http://www.stat.colostate.edu/~bradb/files/

Bollini, P., Pampallona, S., Tibaldi, G., Kupelnick, B., & Munizza, C. (1999). Meta-analysis of dose-effect relationships in randomized clinical trials. *British Journal of Psychiatry, 174,* 297–303.

*Cen, S. Y. (2000) *The effect of traditional Chinese therapeutic massage on individuals with neck pain.* Unpublished master's thesis, California State University, Northridge.

*Chang, M. Y., Wang, S. Y., & Chen, C. H. (2002). Effects of massage on pain and anxiety during labour: A randomized controlled trial in Taiwan. *Journal of Advanced Nursing, 38,* 68–73.

Chen, M. L., Lin, L. C., Wu, S. C., & Lin, J. G. (1999). The effectiveness of acupressure in improving the quality of sleep of institutionalized residents. *Journals of Gerontology: Series A: Medical Sciences, 54,* M389–M394.

*Cherkin, D. C., Eisenberg, D., Sherman, K. J., Barlow, W., Kaptchuk, T. J., Street, J., et al. (2001). Randomized trial comparing traditional Chinese medical acupuncture, therapeutic massage, and self-care education for chronic low back pain. *Archives of Internal Medicine, 161,* 1081–1088.

*Chin, C. C. (1999). The effects of back massage on surgical stress responses and postoperative pain (Doctoral dissertation, Case Western Reserve University, 1999). *Dissertation Abstracts International, 61,* 776.

Conners, C. K. (1969). A teacher rating scale for use in drug studies with children. *American Journal of Psychiatry, 126,* 884–889.

*Cottingham, J. T., Porges, S. W., & Richmond, K. (1988). Shifts in pelvic inclination angle and parasympathetic tone produced by Rolfing soft tissue manipulation. *Physical Therapy, 68,* 1364–1370.

Curtis, K. A., Roach, K. E., Applegate, E. B., Amar, T., Benbow, C. S., Genecco, T. D., et al. (1995). Development of the Wheelchair User's Shoulder Pain Index. *Paraplegia, 33,* 290–293.

*Delaney, J. P., Leong, K. S., Watkins, A., & Brodie, D. (2002). The short-term effects of myofascial trigger point massage therapy on cardiac autonomic tone in healthy subjects. *Journal of Advanced Nursing, 37,* 364–371.

Derogatis, L. R. (1983). *SCL-90-R administration, scoring and procedures manual.* Towson, MD: Clinical Psychometric Research.

*Diego, M. A., Field, T., Hernandez-Reif, M., Hart, S., Brucker, B., Field, T., et al. (2002). Spinal cord patients benefit from massage therapy. *International Journal of Neuroscience, 112,* 133–142.

*Diego, M. A., Field, T., Hernandez-Reif, M., Shaw, K., Friedman, L., & Ironson, G. (2001). HIV adolescents show improved immune function following massage therapy. *International Journal of Neuroscience, 106,* 35–45.

Donnelly, C. J., & Wilton, J. (2002). The effect of massage to scars on active range of motion and skin mobility. *British Journal of Hand Therapy, 7,* 5–11.

Duval, S., & Tweedie, R. (2000). A nonparametric "trim and fill" method of accounting for publication bias in meta-analysis. *Journal of the American Statistical Association, 95,* 89–98.

*Dyson-Hudson, T. A., Shiflett, S. C., Kirshblum, S. C., Bowen, J. E., & Druin, E. L. (2001). Acupuncture and Trager psychophysical integration in the treatment of wheelchair user's shoulder pain in individuals with spinal cord injury. *Archives of Physical Medicine and Rehabilitation, 82,* 1038–1046.

Eisenberg, D. M., Davis, R. B., Ettner, S. L., Appel, S., Wilkey, S., Van Rompay, M., et al. (1998). Trends in alternative medicine use in the United States, 1990–1997: Results of a follow-up national survey. *Journal of the American Medical Association, 280,* 1569–1575.

Elton, D., Stanley, G., & Burrows, G. (1983). *Psychological control of pain.* New York: Grune & Stratton.

Ernst, E. (1998). Does post-exercise massage treatment reduce delayed onset muscle soreness? A systematic review. *British Journal of Sports Medicine, 32,* 212–214.

Fakouri, C., & Jones, P. (1987). Relaxation Rx: Slow stroke back rub. *Journal of Gerontological Nursing, 13,* 32–35.

Ferrell-Torry, A. T., & Glick, O. J. (1993). The use of therapeutic massage as a nursing intervention to modify anxiety and the perception of cancer pain. *Cancer Nursing, 16,* 93–101.

Field, T. M. (1998). Massage therapy effects. *American Psychologist, 53,* 1270–1281.

*Field, T., Diego, M., Cullen, C., Hernandez-Reif, M., Sunshine, W., & Douglas, S. (2002). Fibromyalgia pain and substance p decrease and sleep improves after massage therapy. *Journal of Clinical Rheumatology, 8,* 72–76.

Field, T., Grizzle, N., Scafidi, F., & Schanberg, S. (1996). Massage and relaxation therapies' effects on depressed adolescent mothers. *Adolescence, 31,* 903–911.

Field, T., Hernandez-Reif, M., Hart, S., Theakston, H., Schanberg, S., & Kuhn, C. (1999). Pregnant women benefit from massage therapy. *Journal of Psychosomatic Obstetrics and Gynaecology, 20,* 31–38.

Field, T. M., Hernandez-Reif, M., Quintino, O., Schanberg, S., & Kuhn, C. (1998). Elder retired volunteers benefit from giving massage therapy to infants. *Journal of Applied Gerontology, 17,* 229–239.

*Field, T., Ironson, G., Scafidi, F., & Nawrocki, T., Gonclaves, A., & Burman, I. (1996). Massage therapy reduces anxiety and enhances EEG pattern of alertness and math computations. *International Journal of Neuroscience, 86,* 197–206.

Field, T., Morrow, C., Valdeon, C., Larson, S., Kuhn, C., & Schanberg, S. (1992). Massage reduces anxiety in child and adolescent psychiatric patients. *Journal of the American Academy of Child & Adolescent Psychiatry, 31,* 124–131.

Field, T., Peck, M., Hernandez-Reif, M., Krugman, S., Burman, I., & Ozment-Schenck, L. (2000). Postburn itching, pain, and psychological symptoms are reduced with massage therapy. *Journal of Burn Care Rehabilitation, 21,* 189–193.

Field, T., Peck, M., Krugman, S., Tuchel, T., Schanberg, S., Kuhn, C., et al. (1998). Burn injuries benefit from massage therapy. *Journal of Burn Care and Rehabilitation, 19,* 241–244.

Field, T., Quintino, O., Henteleff, T., Wells-Keife, L., & Delvecchio-

Feinberg, G. (1997). Job stress reduction therapies. *Alternative Therapies, 3,* 54–56.

Field, T., Schanberg, S., Kuhn, C., Field, T., Fierro, K., Henteleff, T., et al. (1998). Bulimic adolescents benefit from massage therapy. *Adolescence, 33,* 555–563.

Field, T. M., Sunshine, W., Hernandez-Reif, M., Quintino, O., Schanberg, S., Kuhn, C., et al. (1997). Massage therapy effects on depression and somatic symptoms in chronic fatigue syndrome. *Journal of Chronic Fatigue Syndrome, 3,* 43–51.

*Fischer, R. L., Bianculli, K. W., Sehdev, H., & Hediger, M. L. (2000). Does light pressure effleurage reduce pain and anxiety associated with genetic amniocentesis? A randomized clinical trial. *Journal of Maternal-Fetal Medicine, 9,* 294–297.

*Fraser, J., & Kerr, J. R. (1993). Psychophysiological effects of back massage on elderly institutionalized patients. *Journal of Advanced Nursing, 18,* 238–245.

Fritz, S. (2000). *Mosby's fundamentals of therapeutic massage*. St. Louis, MO: Mosby.

Glaser, D. (1990). The effects of a massage program on reducing the anxiety of college students (Master's thesis, San Jose State University, 1990). *Masters Abstracts International, 29,* 263.

*Groer, M., Mozingo, J., Droppleman, P., Davis, M., Jolly, M. L., Boynton, M., et al. (1994). Measures of salivary secretory immunoglobulin A and state anxiety after a nursing back rub. *Applied Nursing Research, 7,* 2–6.

*Hemenway, C. B. (1993). The effects of massage on pain in labor (Master's thesis, University of Florida, 1993). *Masters Abstracts International, 33,* 515.

*Hernandez-Reif, M., Dieter, J., Field, T., Swerdlow, B., & Diego, M. (1998). Migraine headaches are reduced by massage therapy. *International Journal of Neuroscience, 96,* 1–11.

*Hernandez-Reif, M., Field, T., Field, T., & Theakston, H. (1998). Multiple sclerosis patients benefit from massage therapy. *Journal of Bodywork and Movement Therapies, 2,* 168–174.

*Hernandez-Reif, M., Field, T., Krasnegor, J., & Theakston, H. (2001). Lower back pain is reduced and range of motion increased after massage therapy. *International Journal of Neuroscience, 106,* 131–145.

*Hernandez-Reif, M., Field, T., Krasnegor, J., Theakston, H., Hossain, Z., & Burman, I. (2000). High blood pressure and associated symptoms were reduced by massage therapy. *Journal of Bodywork and Movement Therapies, 4,* 31–38.

*Hernandez-Reif, M., Field, T., Largie, S., Cullen, C., Beutler, J., Sanders, C., et al. (2002). Parkinson's disease symptoms are differentially affected by massage therapy vs. progressive muscle relaxation: A pilot study. *Journal of Bodywork and Movement Therapies, 6,* 177–182.

*Hernandez-Reif, M., Martinez, A., Field, T., Quintero, O., Hart, S., & Burman, I. (2000). Premenstrual symptoms are relieved by massage therapy. *Journal of Psychosomatic Obstetrics and Gynecology, 21,* 9–15.

*Hsieh, C. Y., Phillips, R. B., Adams, A. H., & Pope, M. H. (1992). Functional outcomes of low back pain: Comparison of four treatment groups in a randomized controlled trial. *Journal of Manipulative and Physiological Therapeutics, 15,* 4–9.

Hudson-Cook, N., Tomes-Nicholson, K., & Breen, A. (1989). A revised Oswestry disability questionnaire. In M. O. Roland & J. R. Jennifer (Eds.), *Back pain: New approaches to rehabilitation and education* (pp. 197–204). New York: Manchester University Press.

Hughes, J. E. (1987). Psychological and social consequences of cancer. *Cancer Surveys, 6,* 455–475.

Hulme, J., Waterman, H., & Hillier, V. F. (1999). The effect of foot massage on patients' perception of care following laparoscopic sterilization as day case patients. *Journal of Advanced Nursing, 30,* 460–468.

Ingram, R. E., & Siegle, G. J. (2002). Contemporary methodological issues in the study of depression: Not your father's Oldsmobile. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression* (pp. 86–114). New York: Guilford Press.

Ironson, G., Field, T., Scafidi, F., Kumar, M., Patarca, R., Price, A., et al. (1996). Massage therapy is associated with enhancement of the immune system's cytotoxic capacity. *International Journal of Neuroscience, 84,* 205–218.

Kovacs, M. (1992). *The Children's Depression Inventory: A self-rated depression scale for school-aged youngsters*. Unpublished manuscript.

Labyak, S. E., & Metzger, B. L. (1997). The effects of effleurage backrub on the physiological components of relaxation: A meta-analysis. *Nursing Research, 46,* 59–62.

Leak, A. M., Cooper, J., Dyer, S., Williams, K. A., Turner-Stokes, L., & Frank, A. O. (1994). The Northwick Park Neck Pain Questionnaire devised to measure neck pain and disability. *British Journal of Rheumatology, 33,* 469–474.

*Leivadi, S., Hernandez-Reif, M. H., Field, T., O'Rourke, M., D'Arienzo, S., Lewis, D., et al. (1999). Massage therapy and relaxation effects on university dance students. *Journal of Dance Medicine and Science, 3,* 108–112.

*Levin, S. R. (1990). *Acute effects of massage on the stress response*. Unpublished master's thesis, University of North Carolina, Greensboro.

Lin, E. H., Katon, W. J., Simon, G. E., Von Korff, M., Bush, T. M., Rutter, C. M., et al. (1997). Achieving guidelines for the treatment of depression in primary care: Is physician education enough? *Medical Care, 35,* 831–842.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Thousand Oaks, CA: Sage.

Luscombe, B. (2002, July 29). Massage goes mainstream. *Time, 160,* 48–50.

Malkin, K. (1994). Use of massage in clinical practice. *British Journal of Nursing, 3,* 292–294.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of Mood States*. San Diego, CA: Educational and Industrial Testing Service.

Melzack, R. (1975). The McGill Pain Questionnaire: Major properties and scoring methods. *Pain, 1,* 277–299.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. *Pain, 30,* 191–197.

Melzack, R., & Wall, P. D. (1965, November 19). Pain mechanisms: A new theory. *Science, 150,* 971–979.

*Menard, M. B. (1995). The effect of therapeutic massage on post surgical outcomes (Doctoral dissertation, University of Virginia, 1995). *Dissertation Abstracts International, 57,* 276.

Merskey, H., Albe-Fessard, D. G., Bonica, J. J., Carmen, A., Dubner, R., Kerr, F. W. L., et al. (1979). IASP sub-committee on taxonomy. *Pain, 6,* 249–252.

Moos, R. H. (1968). The development of a menstrual distress questionnaire. *Psychosomatic Medicine, 30,* 853–867.

*Mueller Hinze, M. L. (1988). The effects of therapeutic touch and acupressure on experimentally-induced pain (Doctoral dissertation, University of Texas at Austin, 1988). *Dissertation Abstracts International, 49,* 4755.

*Okvat, H. A., Oz, M. C., Ting, W., & Namerow, P. B. (2002). Massage therapy for patients undergoing cardiac catheterization. *Alternative Therapies in Health and Medicine, 8,* 68–75.

Ottenbacher, K. J., Muller, L., Brandt, D., Heintzelman, A., Hojem, P., & Sharpe, P. (1987). The effectiveness of tactile stimulation as a form of early intervention: A quantitative evaluation. *Developmental and Behavioral Pediatrics, 8,* 68–76.

Oumeish, O. Y. (1998). The philosophical, cultural, and historical aspects of complementary, alternative, unconventional, and integrative medicine in the Old World. *Archives of Dermatology, 134,* 1373–1386.

Phillips, B. N., Martin, R. P., & Meyers, J. (1972). Interventions in relation to anxiety in school. In C. D. Spielberger (Ed.), *Anxiety: Vol. 2. Current trends in theory and research* (pp. 409–464). New York: Academic Press.

Pinquart, M., & Soerensen, S. (2001). How effective are psychotherapeutic and other psychosocial interventions with older adults? A meta-analysis. *Journal of Mental Health and Aging, 7,* 207–243.

Popkin, M. K., Callies, A. L., Lentz, R. D., Cohen, E. A., & Sutherland, D. E. (1988). Prevalence of major depression, simple phobia, and other psychiatric disorders in patients with long-standing Type-1 diabetes mellitus. *Archives of General Psychiatry, 45,* 64–68.

*Preyde, M. (2000). Effectiveness of massage therapy for subacute low-back pain: A randomized controlled trial. *Canadian Medical Association Journal, 162,* 1815–1820.

Radloff, L. (1977). The CES–D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1,* 385–401.

Reed, B. V., & Held, J. (1988). Effects of sequential connective tissue massage on autonomic nervous system of middle-aged and elderly adults. *Physical Therapy, 68,* 1231–1234.

*Rexilius, S. J., Mundt, C. A., Megel, M. E., & Agrawal, S. (2002). Therapeutic effects of massage therapy and healing touch on caregivers of patients undergoing autologous hematopoietic stem cell transplant. *Oncology Nursing Forum, 29,* E35–E44.

Reynolds, C. R., & Richmond, B. O. (1985). *Revised Children's Manifest Anxiety Scale (RCMAS) manual.* Los Angeles: Western Psychological Services.

*Richards, K. C. (1993). The effect of a muscle relaxation, imagery, and relaxing music intervention and a back massage on the sleep and psychophysiological arousal of elderly males hospitalized in the critical care environment (Doctoral dissertation, University of Texas at Austin, 1993). *Dissertation Abstracts International, 54,* 2443.

Rosenthal, R. (1998). Writing meta-analytic reviews. In A. E. Kazdin (Ed.), *Methodological issues and strategies in clinical research* (2nd ed., pp. 767–790). Washington, DC: American Psychological Association.

Salvo, S. G. (1999). *Massage therapy: Principles and practice.* Philadelphia: Saunders.

Sarafino, E. P. (2002). *Health psychology: Biopsychosocial interactions.* New York: Wiley.

Scafidi, F., Field, T., Schanberg, S., Bauer, C., Vega-Lahr, N., Garcia, R., et al. (1986). Effects of tactile/kinesthetic stimulation on the clinical course and sleep/wake behavior of preterm neonates. *Infant Behavior and Development, 13,* 91–105.

Schachner, L., Field, T., Hernandez-Reif, M., Duarte, A. M., & Krasnegor, J. (1998). Atopic dermatitis symptoms decreased in children following massage therapy. *Pediatric Dermatology, 15,* 390–395.

*Scherder, E., Bouma, A., & Steen, L. (1998). Effects of peripheral tactile nerve stimulation on affective behavior of patients with probable Alzheimer's disease. *American Journal of Alzheimer's Disease, 13,* 61–69.

*Shulman, K. R., & Jones, G. E. (1996). The effectiveness of massage therapy intervention on reducing anxiety in the workplace. *Journal of Applied Behavioral Science, 32,* 160–173.

Spielberger, C. D. (1972). Conceptual and methodological issues in anxiety research. In C. D. Spielberger (Ed.), *Anxiety: Vol. 2. Current trends in theory and research* (pp. 481–493). New York: Academic Press.

Spielberger, C. D. (1983). *Manual for the State–Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

*Stratford, P. W., Levy, D. R., Gauldie, S., Miseferi, D., & Levy, K. (1989). The evaluation of phonophoresis and friction massage as treatments for extensor carpi radialis tendinitis: A randomized controlled trial. *Physiotherapy Canada, 41,* 93–99.

Sunshine, W., Field, T. M., Quintino, O., Fierro, K., Kuhn, C., Burman, I., et al. (1996). Fibromyalgia benefits from massage therapy and transcutaneous electrical stimulation. *Journal of Clinical Rheumatology, 2,* 18–22.

Tiemens, B. G., Ormel, J., Jenner, J. A., van der Meer, K., Van Os, T. W., van den Brink, R. H., et al. (1999). Training primary-care physicians to recognize, diagnose and manage depression: Does it improve patient outcomes? *Psychological Medicine, 29,* 833–845.

Tiidus, P. M. (1999). Massage and ultrasound as therapeutic modalities in exercise-induced muscle damage. *Canadian Journal of Applied Physiology, 24,* 267–278.

Turner, P. R., Valtierra, M., Talken, T. R., Miller, V. I., & DeAnda, J. R. (1996). Effect of session length on treatment outcome for college students in brief therapy. *Journal of Counseling Psychology, 43,* 228–232.

Wampold, B. E. (2001). *The great psychotherapy debate.* Mahwah, NJ: Erlbaum.

Watson, D. (2000). *Mood and temperament.* New York: Guilford Press.

*Weinrich, S. P., & Weinrich, M. C. (1990). The effect of massage on pain in cancer patients. *Applied Nursing Research, 3,* 140–145.

Weisz, J. R., Weiss, B., Alicke, M. D., & Klotz, M. L. (1987). Effectiveness of psychotherapy with children and adolescents: A meta-analysis for clinicians. *Journal of Consulting and Clinical Psychology, 55,* 542–549.

*Wendler, M. C. (1999). An investigation of selected outcomes of Tellington touch in healthy soldiers (Doctoral dissertation, University of Colorado, 1999). *Dissertation Abstracts International, 60,* 5439.

White House Commission on Complementary and Alternative Medicine Policy. (2002, March). *White House Commission on Complementary and Alternative Medicine Policy: Final report.* Retrieved May 4, 2003, from http://govinfo.library.unt.edu/whccamp/finalreport.html

*Wilkie, D. J., Kampbell, J., Cutshall, S., Halabisky, H., Harmon, H., Johnson, L. P., et al. (2000). Effects of massage on pain intensity, analgesics and quality of life in patients with cancer pain: A pilot study of a randomized clinical trial conducted within hospice care delivery. *Hospice Journal, 15,* 31–53.

Yyldyz, A., & Sachs, G. S. (2001). Administration of antidepressants: Single versus split dosing: A meta-analysis. *Journal of Affective Disorders, 66,* 199–206.

Received August 8, 2002
Revision received June 3, 2003
Accepted June 4, 2003 ■