



Massage Therapy Research Review

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ABSTRACT

This narrative review on massage therapy effects involved a literature search for research that was published in the years 2016-2020. The review includes studies on massage therapy effects on preterm pain and growth, newborn hyperbilirubinemia and infant colic. The pediatric literature includes studies on behavior problems including ADHD and aggression and physical conditions including diarrhea, asthma, immune function and pain. The adult studies include massage therapy effects on psychological problems including stress and anxiety and physical conditions including fatigue, sleep disturbances, post-burn scarring, gastrointestinal problems and dementia. The musculoskeletal studies are focused on range of motion, balance, muscle activity, grip strength and performance recovery. The massage for pain literature is the most extensive including pain associated with labor, cesarean delivery, shoulder, neck, low back and upper back pain, arthritis, fibromyalgia, multiple sclerosis, cancer, neuropathy, post-surgery, hospice and aging. The physiological/biochemical measures that have been used include systolic and diastolic blood pressure, heart rate, vagal activity, facial blood flow, EEG, cortisol and oxytocin. This section is followed by a discussion on potential underlying mechanisms and methodological limitations. The research continues to have methodological limitations including that the studies cannot be double blinded, they are typically not multivariate studies and they are often biased by their reliance on self-report. Nonetheless, the randomized controlled trials included here as well as systematic reviews and meta-analyses have concluded that massage therapy is typically effective when it is compared to treatment as usual control groups. More research is needed on massage therapy versus active control groups (e.g. exercise and physical therapy) in randomized, controlled trials.

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Since the publication of a rather extensive massage therapy research review by Field in 2016, a significant literature has amassed on massage therapy effects on a variety of conditions that are reviewed here. This narrative review on massage therapy effects involved a literature search for research that was published in the years 2016-2020. Empirical studies, systematic reviews and meta-analyses on massage therapy effects were found on PubMed and PsycINFO by entering the terms massage therapy and the publication years 2016-2020. The studies were evaluated for treatment integrity, sample size and reliability of measures. Of the 118 papers that were initially selected for review, 42 were excluded because the entire article could not be located or the full paper was in a foreign language or the research failed to meet the criteria of being an empirical study (single-arm, randomized controlled waitlist or treatment comparison), a systematic review or a meta-analysis. Qualitative studies, case studies and small sample size studies were also excluded. The intent of the narrative review is to reflect the wide scope of the published literature from these recent years rather than to focus on one topic.

This literature search yielded studies on massage therapy effects on preterm pain and growth, newborn hyperbilirubinemia and infant colic. The pediatric research reviewed here includes studies on behavior problems including ADHD and aggression and physical conditions including diarrhea, motor problems, asthma, immune function and pain. The adult studies include massage therapy effects on psychological problems including stress and anxiety, and physical conditions including fatigue, sleep, post-burn scarring, gastrointestinal problems and dementia. The musculoskeletal studies are focused on range of motion, balance, muscle activity and pain, grip strength and performance recovery. The massage for pain literature is the most extensive including pain associated with labor, cesarean delivery, shoulder, neck, low back and upper

back pain, arthritis, fibromyalgia, multiple sclerosis, cancer, neuropathy, post-surgery, and hospice. The physiological/biochemical measures that have been used include systolic and diastolic blood pressure, heart rate, vagal activity, facial blood flow, EEG, cortisol and oxytocin. This section is followed by a discussion on potential underlying mechanisms and methodological limitations. In general, the randomized controlled studies reviewed here as well as the systematic reviews and meta-analyses have concluded that massage therapy is typically effective when it is compared to treatment as usual control groups. However, the data are more mixed on massage therapy versus active control groups such as exercise and physical therapy. The research continues to have methodological limitations including that the studies cannot be double-blinded, they are typically not multivariate studies and they are often biased by their reliance on self-report. This review is divided into sections to reflect these categories including the prevalence of massage use, infant massage, pediatric massage, adult massage, physiological/biochemical measures, potential underlying mechanisms and methodological limitations.

Prevalence of Massage Therapy

The general use of massage therapy has been determined by a few complementary therapy surveys. In a survey on medical records from integrated health delivery systems, chiropractic was the most frequently used therapy (67%) while massage therapy was used by only 15% (McCubbin, Kempe & Beck et al, 2017). Spinal/truncal pain was the most commonly reported condition for which adults sought massage therapy (71%). Most of the users were female (62%) and most were non-Hispanic-white (73%).

In cross-sectional data from the 2012 National Health Interview Survey for Adults (N=34,525), the prevalence of massage use was again low at 13% for a lifetime and even lower at 7% for the last year (15.4 million) (Sundberg, Cramer, Sibbritt, Adams & Lauche 2017). Those who

used massage in the last year were more likely to be female, at least high school educated with an income of greater than \$15,000, diagnosed with spinal pain or arthritis, reporting low physical activity levels and consuming alcohol. The massage therapy was used for general wellness or disease prevention (56%) but also for musculoskeletal problems (42%) for which 85% suggested massage had helped them “some” or “a great deal”.

The low frequency of massage therapy use probably relates to the lack of insurance coverage. As was noted in a recent regional analysis of US insurance reimbursement guidelines for massage therapy, of the 26 health insurance policies reviewed across seven US companies, 23% stated that massage therapy was limited to 15-minute increments, only 19% covered massage and 27% required physician prescription (Miccio & Cowen, 2018). The massage techniques that qualified for reimbursement included traction, myofascial release, mobilization/manipulation, manual lymphatic drainage and Swedish massage. Although many other therapists were directly billing for massage, massage therapists were excluded as covered providers for 27% of the policies. As the authors concluded, this exclusion of massage therapists as eligible providers violates the Affordable Care Act’s non-discriminatory policy.

Despite the low frequency of use, the rate of referrals from general practitioners to massage therapists was relatively high in one survey at 83% (Rodondi, Dubois, Bill, Koutaissoff, Ros et al., 2018) and 75% in a recent national survey (Cottingham, Adams, Vempati, Dunn & Sibbritt 2018). And, in this survey, the majority of massage therapists referred clients to general practitioners (83%). The majority of massage therapists also valued research (95%) and perceived that it impacted their practice (88%). The value for research was, in turn, correlated with the size of their caseload and the level of their academic qualifications.

Another issue for massage therapists involves their energy expenditure. In a recent study, energy expenditure was evaluated in massage therapists (Wiecek, Szymura, Maciejczyk, Szygula, Cempla et al., 2018). A stress test was performed including massage techniques of stroking, kneading, shaking, beating, rubbing and direct vibration during which heart rate and respiration were assessed along with energy expenditure. The results suggested that all of these measures showed greater energy expenditure for the massage therapy rubbing technique.

Most of the prevalence data relates to massage use in the community by paying clients typically seeking treatment for chronic pain. In contrast, most of the research on massage therapy effects has involved participants who have been offered therapy to assess its effects on their psychological and/or physical conditions.

Preterm Newborn Pain, Sleep and Growth

One of the largest literatures has amassed on the positive effects of massage therapy on reducing pain and enhancing sleep and growth in preterm infants (see Field 2016 for a review).

Pain Relief

Massage therapy has been typically used to alleviate pain during the heel stick (venipuncture) procedure. In one study, for example, a massage group first received a two-minute upper limb massage before the heel stick and then served as their own control and received nothing, and in the second group, the control condition occurred first followed by the massage (Chik, Ip & Choi, 2017). The mean pain scores were significantly lower when the infants received massage versus the no treatment control condition. In another heel stick study, newborns were randomly assigned to a group that received breast-feeding, a group that received massage and a control group to assess those effects on pain (Zargham-Bouroujeni, Elsagh & Mohammadzadeh, 2017). The responses of the newborns were assessed on

the Neonatal Infant Pain Scale which revealed the lowest pain scores for the massage group.

Sleep

In a study on the effects of massage on sleep, the Field moderate pressure massage technique (Field, Schanberg, Scafidi, Bauer, Vega-Lahr et al., 1986) was used for the 15-minute per day massages for five days (Baniyasi, Hosseini, Abdollahyar & Sheikhbardsiri, 2018). The findings suggested reduced motor activity and increased sleep following the massages, suggesting that they had a soothing and calming effect on the preterm newborns.

Growth

Despite dozens of earlier studies that documented greater growth in preterm infants following massage therapy, many replication studies continue to focus on growth. Most recently, in a randomized controlled trial (N=218 preterm neonates less than 32 weeks gestation), several measures revealed significantly greater growth for those who were massaged 3 times a day for 5 days (Elmoneim et al, 2020). These included greater daily weight gain (19 versus 6 grams per day), growth velocity, total body mass, fat mass, lean mass, and bone mineral density.

Increasingly parents have been providing the massages. In a recent study, for example, preterm infants received a daily 15-minute massage from their mothers in a quasi-experimental study (Alvarez, Fernandez, Gomez-Salgado, Rodriguez-Gonzalez, Roson & Lapena, 2019). As was expected, weight and head circumference were significantly increased following the 10-day massage period. However, this was not a randomized controlled study. In a randomized controlled trial in which 112 preterm infants were randomly assigned to a massage or control group, the massage group who received the Field massage protocol also showed greater gains in height, weight and head circumference after two weeks of massages that were performed by their mothers (Zhang & Wang, 2019).

In a systematic review of 23 massage studies, massage was shown to significantly increase the growth of preterm infants (Alvarez et al., 2019). The authors suggested that this growth may have resulted from increased vagal activity, increased gastric motility and increased insulin levels that had been documented in preterm newborns in earlier studies (Diego, Field, Hernandez-Reif, Deeds, Ascencio & Begert, 2007; Field, Diego, Hernandez-Reif, Dieter, Kumar, Schanberg & Kuhn 2008). Other notable benefits in this study were reduced neonatal stress, shorter hospital stay, less neonatal sepsis and a positive effect on brain development (Alvarez et al., 2019). In a review of randomized controlled trials on massage for preterm newborns, most of the trials suggested increased weight gain (Niemi, 2017). This author, like the previous author, suggested increased vagal activity as a potential underlying mechanism for the increased weight gain.

Increased vagal activity may not only contribute to physical growth but also to the enhanced gastrointestinal function in preterm infants. In a pilot study in which a 15 minute massage was performed twice daily for two weeks, there was not only an increase in physical growth, height and chest circumference but also in gastrointestinal function as indicated by the number of bowel movements that significantly increased (Choi, Kim, Oh, Lee, Kim, et al., 2016).

Several of the recent preterm infant massage therapy studies have assessed the use of oils with massage. In one study, a five-day course of sunflower oil/ moderate pressure massage was assessed for its effects on weight gain and length of stay in the NICU (Taheri, Goudarzi, Shariat, Nariman & Matin, 2018). In this study, the Field massage was performed three times a day. The massage group showed a significant increase in daily weight and end-of-study weight gain and the hospital stay was significantly shorter. In a single-blind randomized controlled clinical trial, almond oil massage was compared to a massage without oil again using the Field

massage protocol (Jabraeile, Rasooly, Farshi & Malakouti, 2016). This was performed for 15 minutes three times a day for 10 days. The neonatal weight gain with the oil massage averaged 21 g daily whereas the massage without oil was only 7 g per day, highlighting the significant effects of oil massage. This result was not surprising inasmuch as the absorption of oil through the skin contributes to weight gain. In a meta-analysis on the effects of oil massage, eight studies of the 625 papers retrieved suggested that oil massage effects were greater for infant weight gain, length and head circumference but not for neurobehavioral scores (Li, Zhong & Tang, 2016). This meta-analysis also established that oil massage did not have adverse skin reactions which had been a contraindication for oil massage in previous years.

Infant Massage Therapy

The infant massage therapy studies in the recent literature have shown decreased bilirubin levels, colic and sleep problems following massage therapy.

Hyperbilirubinemia

In a study that combined massage therapy with phototherapy, the massaged infants who were randomly assigned to receive four days of massage and phototherapy showed a lower bilirubin level than the phototherapy alone group by the fourth day. (Ahmadipour, Mardani, Mohsenzadeh, Baharvand & Nazeri 2019). The massage group also experienced a shorter duration of hospitalization related to the extra therapy they received. In another randomized control clinical trial, newborns who receive phototherapy for hyperbilirubinemia (N=50) received massage therapy throughout the duration of their phototherapy for 15 minutes twice per day (Korkmaz & Esenay, 2020). After the treatment period, the total serum bilirubin levels were significantly lower and the frequency of defecation, urination and feeding were significantly greater. In a review of clinical trials on massage therapy for hyperbilirubinemia, the Field massage was given in most of the trials

(Garg, Kabra & Balasubramanian, 2019). And, in most of the trials, the bilirubin levels were decreased and the stool frequency was increased. Similarly, in a meta-analysis of six randomized controlled trials, massage therapy was associated with significantly lower serum bilirubin levels within four days (Zhang, Wang, Wang & Tang, 2018).

Colic

Infant colic has also been decreased by massage therapy. In a randomized controlled trial, 100 colic infants less than 12-weeks-old were randomly assigned to a massage therapy or a rocking group (Sheidaei, Abadi, Zayeri, Nahidi, Gazerani et al., 2016). The massage group mothers gave their infants 15–20 minute massages once a day and once at night before sleeping for a week while the rocking group was rocked for 5–25 minutes whenever the colic symptoms appeared. The massage therapy was more effective in reducing the mean number of daily cries, the duration of cries as well as increasing the duration of sleep. Although the authors concluded that massage therapy was more effective in reducing colic symptoms, the results were confounded given that the intervention protocols were very different in terms of timing and duration. And, a question for a future study might be whether a massage specifically focused on the abdomen at the time of colic might be even more effective.

Sleep

Mothers have been increasingly used as massage therapists in studies on infant and pediatric massage given that they can provide their infants a greater dose of daily massages and also benefit themselves from giving the massages from stimulating the pressure receptors in their hands (Field, 2016). Examples of the benefits of mother-delivered massage therapy include improved mother-infant interactions and better sleep in the mothers and infants. For example, in a study on infant massage classes, mother-infant interactions were observed and were coded for emotional availability of both the mother and their 2–7-

month-old infants (Porreca, Parolin, Bozza, Freato & Simonelli, 2017). Emotional availability increased for both the mothers and their infants which contributed to their improved mother–infant interactions.

At least two studies could be found in the recent literature on improved mother and infant sleep following mothers massaging their newborns and mothers massaging their infants. In the study on newborns, mothers massaged their infants before bedtime on a daily basis for one month (Field, Gonzalez, Diego, Mindell, 2016). By the end of the study, both the mothers and their infants had fewer night wakings and longer duration sleep time. Those who massaged their infants with lotion had even greater improvements in sleep which probably related to their experiencing more frequent massages because the massages with lotion were more comfortable. In the study on older infants (3-17-months-old), massage was used as a bedtime routine (Mindell, Lee, Leichman & Rotella, 2018). In this study, the massage bedtime routine resulted in fewer night wakings for both the mothers and their infants. Other sleep changes might have occurred if the mothers had used moderate pressure in their massages given that moderate pressure has resulted in more positive effects on sleep than light pressure in several studies (Field, Diego & Hernandez-Reif, 2010).

Pediatric Massage Therapy

In a recently published review on pediatric massage therapy, at least 48 papers were found in the literature from the last decade (Field, 2019). However, very few papers have been published on pediatric massage during the past few years. And, they are scattered across behavior problems including ADHD and aggression and physical conditions including diarrhea, asthma, cystic fibrosis, cerebral palsy and related developmental disabilities, immune function and pain. Given that many of these publications are systematic reviews and meta-analyses, they do represent a growing pediatric massage therapy literature.

Behavior Problems

In a meta-analysis on massage therapy studies for the treatment of ADHD in children and adolescents, eight randomized controlled studies were included (Chen, Yu, Suen, Yu, Ho et al., 2019). Pooled analysis suggested that massage therapy reduced ADHD symptoms more than Ritalin did. In a study on aggression in elementary school children, massage and storytelling were compared (Goncalves, Voos, de Almeida & Caromano, 2017). One group of children received 10 extra classes of massage and another group received 10 extra classes of storytelling for 50 minutes once a week. Both the massage and the storytelling groups as compared to a control group showed a reduction in aggressive behaviors and improved academic performance as reported by their teachers.

Physical Conditions

A greater number of physical conditions versus behavior problems have been addressed in the pediatric massage therapy literature. They include diarrhea, asthma, cystic fibrosis, cerebral palsy and cancer.

Diarrhea. A meta-analysis on pediatric massage for the treatment of diarrhea included 26 studies on 2644 patients (Gao, Jia & Huang, 2018). The authors of the meta-analysis concluded that pediatric massage was significantly more effective than pharmacotherapy in terms of its cure rate and timing. However, like other meta-analyses on other pediatric problems, the quality of evidence was low due to high risk of bias in the studies that were included. These highlight the need for better designed, randomized controlled trials.

Asthma. In a meta-analysis on asthma, 14 studies including 1299 children were reviewed (Wu 2017). Compared with the control groups, the massage therapy groups showed significantly greater increases in FEV1 (forced expiratory volume in the first second after taking a deep breath) as well as PEF (peak expiratory flow or maximum speed of expiration), suggesting significant improvement in

pulmonary function. Again, however, more randomized controlled trials are needed to document the positive effects of massage therapy on asthma in children.

Cystic Fibrosis. In a study on the breathing problems of children with cystic fibrosis, the massage therapy group as compared to a non-treatment control group showed significantly reduced muscle tightness, greater relaxation and less pain as well as improved pulmonary function (Zink, Chini, Cowens, Kremer & Lin, 2019).

Cerebral Palsy. Massage therapy has also been effective with children who have cerebral palsy (CP). In one study, deep cross-friction massage was given for 30 minutes, five times a week for six weeks to children with cerebral palsy (Rasool, Memon, Kiyani & Sajjad, 2017). The massage as compared to the routine physiotherapy received by the control group effectively reduced spasticity in the children with cerebral palsy. In another study, children with CP were randomly assigned to a massage group to receive 20 minutes of massage twice a week for 12 weeks or a control group who continued to receive routine rehabilitation (Lu, Tsai, Lin, Hong & Hwang, 2018). The children with CP showed greater improvement on gross motor scores and sensory sensitivity. The authors of an earlier study that showed reduced spasticity in children with cerebral palsy speculated that increased vagal activity following massage relaxed the nervous system resulting in less spasticity (Hernandez-Reif, Field, Largie, Diego, Manigat, Seoanes & Bornstein, 2005).

Heart surgery. A reduction in pain and the need for medication has been shown in studies on children following heart surgery and on children receiving palliative care. In a study on postoperative massage therapy, children with congenital heart surgery were randomly assigned to receive massage therapy versus reading (Staveski, Boulanger, Erman, Lin, Almgren et al., 2018). The massage therapy group had significantly lower benzodiazepine exposure in the three days following surgery and

lower anxiety scores at the time of discharge. In a study on children receiving palliative care, 10-minute bedside massages were given to the children, and their family caregivers were also given 10-minute massages (Weekly, Riley, Wichman, Tibbits & Weaver 2018). The children showed decreased scores on the Face, Legs, Activity, Cry, Consolability Scale as well as less need for pain medication. The lesser need for pain medication following massage therapy has been attributed to increased serotonin (the body's natural anti-pain neurotransmitter) and/or the reduction in substance P (that causes pain) (Field, Hernandez-Reif, Diego, Schanberg & Kuhn, 2005; Field, Diego, Cullen, Hernandez-Reif, Sunshine, & Douglas, 2002).

Cancer. That children with cancer experience enhanced immune function following massage is not surprising given the literature on improved immune function in adults following massage (Field, 2016). In a systematic review of seven controlled clinical trials on massage in children with cancer, the children's cancer symptoms significantly decreased including a decrease in pain, nausea, stress and anxiety as well as increased white blood cells and neutrophils (Rodriguez-Marsilla et al., 2017). Although natural killer cells were not measured in these studies, they have notably increased in previous studies on adults (Field, 2016). Inasmuch as natural killer cells kill bacterial, viral and cancer cells, they would be an important assay to include in future studies on massaging children with cancer.

Pediatric massage therapy studies have been scattered across these several conditions likely because they are clinical convenience samples involving children/adolescents who are receiving treatments and/or are hospitalized and needing complementary therapies. Also, parents need to be recruited and sign informed consent for their children which is more likely to occur in clinical settings. Although parents could be recruited at their children's school, school-based studies on massage therapy for normal children are not likely to happen given that no-touch policy

mandates are in place at least in public schools. Nonetheless, most of the behavior and physical conditions that have been studied have been helped by massage therapy. Probably the daily dose of massage provided by the parents has contributed to the significant effects. And, the parents have also benefited from giving the massages not only because they are contributing to their child's treatment but also because they are receiving moderate pressure stimulation of pressure receptors under the skin of their hands as they give the massages (Field, 2016).

Adult Studies

Adult massage therapy has been studied for psychological conditions such as stress and anxiety, for physical conditions such as sleep problems, gastrointestinal function and dementia, for musculoskeletal issues including range of motion and performance recovery, and for pain including joint pain and disease-related pain. Not unlike the pediatric massage therapy literature, the adult massage studies cover a wide range of conditions, although most of the studies have focused on pain.

Psychological Conditions

These have included stress and anxiety. Measures of these mood states have been included in almost all the adult massage studies, although some have focused specifically on stress or anxiety.

Stress. Although stress would also underlie most of the physical conditions in this recent massage therapy literature, stress has been the key focus of at least two studies. In one of these, 39 postpartum women were assigned after childbirth to a control group or an experimental group that received meridian acupressure massage for 90 minutes daily over five days (Jung, Choi, Kang, & Choi, 2017). The massage group showed a significantly greater decrease in psychological and subjective stress. In another study, emotional stress was studied before and after mutual massage by stressed couples over a 3-week period (Naruse, Cornelissen & Moss,

2018). The couples' massage significantly reduced stress in both partners. The positive effects on the massager have been related to the stimulation of pressure receptors in the massager's hands (Field, 2016).

Anxiety. Anxiety, as a more specific form of stress, has also been the focus of a study on massage therapy in postpartum women. In this single-blind controlled clinical trial, 100 postpartum women were randomly assigned to a slow-stroke back massage or a control group (Jahdi, Mehrabadi, Mortazavi & Haghani, 2016). The anxiety scores of the massage group were significantly lower by the end of the first postpartum day. In the other anxiety studies, anticipatory anxiety prior to clinical procedures has been reduced. In one of these, foot massage was used to reduce anxiety during a magnetic resonance imaging session (Parmar, Brewer & Szalacha, 2018). In another study, Chinese hand massage was used to reduce anticipatory anxiety in patients waiting for a coronary angiography (Mei, Miao, Chen, Huang & Zheng, 2017). Those in the hand massage group experienced a significantly greater decrease in anxiety. In a similar anticipatory anxiety study, a 20-minute Swedish massage was used to alleviate anxiety prior to the painful skin brushing procedure (debridement) in burn patients (Najafi Ghezellah, 2018).

Anxiety related to chronic illnesses has also been reduced by massage therapy. For example, in a study on breast cancer patients undergoing radiotherapy for breast cancer, a random sample received Swedish massage three times a week for 30 minutes over five weeks (Darabpour, Kheirkhah & Ghasemi, 2016). The massage versus the control group not only showed a decrease in anxiety but also in depression and anger, emotions that are often comorbid (Field, Diego, Hernandez-Reif, Schanberg, Kuhn, Yando & Bendell, 2003). Massage has also been used for adults in palliative care. For example, in a systematic review of three randomized controlled trials comparing massage plus aromatherapy with

massage alone, both types of massage were effective in reducing anxiety among patients receiving palliative care (Hsu, Chi, Chen, Wang, Tung, et al. 2019).

Only one study on generalized anxiety disorder could be found in the recent literature on adult massage (Rapaport, Schettler, Larson, Edwards, Dunlop et al., 2016). In this randomized, single-blind clinical trial, 47 untreated patients with diagnosed generalized anxiety disorder were randomly assigned to twice weekly Swedish massage therapy versus a light touch control condition for six weeks. By the end of week three, the massage group had significantly lower anxiety scores. This finding was not surprising given that light touch has arousing versus calming effects.

Physical Conditions

Several physical conditions have been treated by massage therapy including fatigue and sleep, skin conditions and gastrointestinal function. Of these, sleep disturbances have been the most frequently studied problem.

Fatigue. Although fatigue and sleep are typically related problems, fatigue has been studied apart from sleep in at least a few studies. In one study, fatigue was studied in patients undergoing hemodialysis for which fatigue is one of the most disturbing symptoms (Ahmadidarrehshima, Mohammadpourhodki, Ebrahimi, Keramati & Dianatinasab, 2018). In this study, foot massage and slow stroke back massage were performed twice per week for three weeks. Following the intervention period, foot reflexology massage was more effective than slow stroke back massage at reducing fatigue in the hemodialysis patients. In another study on hemodialysis patients by another research group, foot reflexology twice per week for four weeks was again more effective than back massage for reducing fatigue as well as improving sleep quality (Unal & Balci Akpinar, 2016). However, the patients in this study were not randomly assigned to the different treatment groups. Still another group compared massage therapy with light touch and a waitlist control for breast

cancer-related fatigue (Kinkhead, 2018). Following a six-week treatment period, the mean reduction in PROMIS fatigue scores was greatest for the massage therapy group. That result was expected given that light touch is typically aversive (Field, 2016). But, because it's aversive, it is not a suitable control group.

In a sample of patients who were simply experiencing fatigue or depleted energy, 20 participants were randomized to receive three Thai massages once per week or three Swedish massages once per week (MacSween, Lorrimer, van Schaik, Holmes & van Wersch, 2018). The Swedish massage led to greater relaxation and improved sleep while the Thai massage had a greater effect on energizing, rejuvenating and mentally stimulating the participants. Very few studies have compared different types of massage. That these two forms of massage have different effects is not surprising given they are very different including that Thai massage is conducted on fully clothed individuals, is typically a longer session and involves stretching of limbs rather than rubbing and stroking. And, unfortunately, this study, like many others, was exclusively based on symptom checklists, diary entries and semi-structured interviews.

Sleep. Sleep quality has been the focus of recent massage therapy studies on career women, paracyclists, post-surgery recovery and on cardiac patients. In the study on career women, acupressure massage led to improved sleep as measured by the Pittsburgh Sleep Quality Index after a four-week treatment (Kao, Huang, Chung, Hsu, Tang, et al., 2017). In a study on elite cycling athletes, one-hour massage therapy sessions were given one time per week for four weeks and then for every other week over a six-month treatment period (Kennedy, Patil & Trilk, 2018). At the end of the treatment period, sleep was significantly improved and massage therapy reportedly also helped the recovery of the athletes.

Sleep has also improved during the preoperative period for patients undergoing surgery (Ayik & Ozden, 2018). In this study, patients were

randomly assigned to a back massage group for 10 minutes on the evening before surgery and during the morning of surgery. As compared to a treatment as usual group, sleep quality was improved and anxiety levels were decreased in the massage group. Similarly, sleep quality has been improved in patients residing in intensive care and coronary care units. In a study on intensive care unit patients, the treatment group received a 10-minute back massage and was compared to a control group receiving usual care (Hsu, Guo, S.E. & Chang, 2019). Based on wrist actigraphy and nurse observations, sleep quality and duration were improved along with a reduction in anxiety. Having confirmatory measures is a noteworthy feature of this study, but, surprisingly, pain reduction was not assessed, although that would be expected. Notably more deep sleep would be accompanied by a reduction in substance P that causes pain (Field, Diego, Cullen, Hernandez-Reif, Sunshine & Douglas, 2002).

Sleep disorders are reputedly a common problem among cardiac patients and especially those hospitalized on coronary care units because of environmental and mental factors (Rahmani, Naseri, Salaree & Nehrir, 2016). In a quasi-experimental study on patients in a coronary care unit, three groups including a foot reflexology massage, foot bath and a combination of the two were compared to a control group. (Rahmani et al., 2016). The results showed a greater reduction in sleep disturbance in the combined foot massage /foot bath group than in the other groups. Similarly, in a random allocation study including massage, aromatherapy massage and control groups, the combination of massage and aromatherapy was more effective than massage alone in improving sleep quality in cardiac patients (Cheraghbeigi, Modarresi, Rezaei & Khatony, 2019). In this study, the massage uniquely included both the hands and feet. In another study, the more typical back massage was given to patients with congestive heart failure three times daily from the day of admission until discharge (Sable,

Sivabalan & Shetti, 2017). Both the quality and the duration of sleep improved following the massage, again based on the Pittsburgh Sleep Quality Index completed by the participants.

Skin conditions. Three studies on massage therapy for skin conditions appeared in the recent literature. Two of these related to post-burn scarring and one of these to increasing hair thickness. The objective for applying massage therapy to post-burn scars is to increase the strength and elasticity of the skin that is required for normal mobility as well as to improve cosmetic outcomes (Nedelec, Couture, Calva, Poulin, Chouinard et al., 2019). In a randomized, controlled clinical trial, the effects of a 12-week course of massage therapy were studied in 60 burn survivors (Nedelec et al., 2019). In this study, the massages were given three times a week for the three month period and the scar characteristics were evaluated weekly immediately before and after the massages including elasticity and scar thickness. The results revealed a reduction in thickness at week five and an increase in elasticity at week eight. In a systematic review of the literature on massage for post-burn scarring, eight publications were included in the review on 258 participants (Ault, Plaza & Paratz, 2018). The data suggested a decrease in scar thickness as measured by ultrasonography and improved vascularity and elasticity. As might be expected given this clinical improvement, pain and depression were also decreased.

In a somewhat unrelated study, scalp massage surprisingly increased hair thickness after four minutes of scalp massage per day for 6 months (Koyama, Kobayashi, Hama, Murakami & Ogawa 2016). The data suggested not only that hair thickness increased but also that the scalp massage decreased expression of hair loss-related genes as assessed by DNA microarray analysis.

Gastrointestinal conditions. The two gastrointestinal conditions that appear in the recent literature on massage therapy include constipation and gastric residual volume.

They're both considered serious problems. Constipation has been studied in the elderly and after surgical procedures. For example, in a study on constipation in the elderly, the number of bowel movements, stool weight and stool consistency increased during and after the massage therapy period (Cevik, Cetinkaya, Yigit Gokbel, Menekse, Saza, S. et al., 2018). In addition, the scores on straining decreased and those on completely emptying the bowels increased. However this was a within subjects, non-randomized controlled study. In a randomized controlled trial, abdominal massage was applied for six days postoperatively to reduce constipation (Turan & Ast, 2016). The patients who received abdominal massage defecated more often following the surgery. They also self-reported a decrease in constipation and a resulting increase in their quality of life. In a similar study, acupoint massage was provided for patients undergoing gynecologic laparoscopy to assess the recovery of gastrointestinal function (Ruan, Li, Liu, Li, Ji et al., 2019). As compared to the control group, the massage group showed shorter defecation time and their plasma levels of gastrointestinal hormones were higher including somatostatin and cholecystokinin. This suggests that the stimulation of pressure receptors led to increased gastric motility which led to the release of gastrointestinal hormones that, in turn, modulated the recovery of bowel function. An increase in vagal activity and gastric motility leading to the release of gastrointestinal hormones following massage has been reported previously (Field, 2016).

Gastrointestinal dysfunction is one of the most common problems experienced by patients in intensive care units (Dehghan, Fatehi Poor, Mehdipoor & Ahmadinejad, 2018). In a randomized clinical trial on intensive care patients, a 15 minute abdominal massage was conducted twice a day for three days for one group which was then compared to a group that received only routine care (Dehghan et al., 2018). Gastric residual volume decreased

significantly as did abdominal circumference. Defecation times increased and the prevalence of constipation decreased in the massage group. In a similar study, 20-minute abdominal massages were given twice daily for three days to intensive care unit patients to improve their digestive function (Momenfar, Abdi, Salari, Soroush & Hemmatpour, 2018). Once again, the gastric residual volume was less than that of the randomly assigned control group by the second day of the massage period. Although gastric motility and gastrointestinal hormones were not measured in this study, they are likely mediating variables for the effects of massage on improved gastrointestinal function.

Dementia. Several studies have been conducted using different forms of massage for the physical and psychological symptoms of dementia. In a three-arm parallel group design, three interventions were compared including aroma massage with acupressure plus exercise (group 1), cognitive training plus exercise (group 2) and aroma massage with acupressure plus cognitive training (group 3) (Fung & Tsang, 2018). After three months, the two groups that involved aroma massage with acupressure showed a significant reduction in the severity and distress caused by physical and psychological symptoms of dementia as compared to the cognitive training group. In another aromatherapy massage randomized controlled trial, massages were performed once per week for eight weeks (Yang, Wang & Wang, 2016). Agitated behavior and depression decreased by week five in the intervention group. In a similar study by the same research group, aroma massage therapy was compared to cognitive stimulation therapy and reminiscence therapy with a sample of elderly patients with dementia (Yang, Lee, Chao, Hsu & Wang, 2016). The aroma massage group experienced fewer agitated behaviors and depressive symptoms than the other two groups. In still another randomized controlled trial, patients with dementia received 10 minutes of massage (effleurage, kneading and trigger point therapy)

four times per week for one month (Kapoor, & Orr, 2017). The massage group as compared to the control group experienced a significant reduction in pain. In a meta-analysis, 11 randomized controlled trials were included (Margenfeld, Klocke, C. & Joos, 2019). The pooled analysis for mean changes showed significant effects for manual massage versus control groups on agitation and depression.

Musculoskeletal Changes

Several musculoskeletal changes have followed massage therapy. These include range of motion, balance, muscle activity, and recovery following athletic performance.

Range of motion. Range of motion has increased following massage in several joints including the ankle, the hip, the forearm and the shoulder. In a study that compared stretching alone or combined with self-massage, participants had two sessions of muscle stretches after a 60 second control condition and 60 seconds of self-massage with therapy balls (Capobianco, Mazzo & Enoka, 2019). The change in ankle angle was greater after self-massage with therapy balls. These gains were greater in adults who were less flexible. In another range of motion study, pressure massage was provided for the calf muscles as a treatment for Achilles Tendonopathy and the pressure massage group was compared to a group who engaged in eccentric exercise and a group who experienced both pressure massage and eccentric exercise (Stefansson, Brandsson,

Langberg & Arnason 2019). Ankle range of motion increased significantly for the pressure massage group. This result highlighted the problem of adding exercise to massage and diminishing the effects of massage by the work involved in exercise. A similar pressure massage called friction massage was used to increase range of motion in the ankle (Iwamoto, Mizukami, Asakawa, Yoshio, Ogaki et al. 2016). Near-infrared spectroscopy was used to evaluate its effects. Oxygenated hemoglobin was significantly greater after the massage as was ankle dorsiflexion. The authors suggested that the massage had stimulated venous return in the lower leg. This mechanism also may explain the results of the previous study.

Range of motion in the hip has also been improved by massage (Akazawa, Okawa, Kishi, Nakatani, Nishikawa et al., 2016). In this study an interesting control strategy was used involving the right or the left leg being randomly assigned to the massage group and the other leg being assigned to the control group. In addition, this was a self-massage study that involved massaging the hamstrings three minutes daily five times per week for three months. After six and 12 weeks of intervention, the massage group had greater hip range of motion. Range of motion has decreased in a more recent hip massage study (Field, Sauvageau, Gonzalez & Diego, 2019). In this study, goniometer measures confirmed self-report measures. And, not surprisingly, sleep also improved.

Table 1. Infant conditions and first authors.

Condition	First Author
<u>Preterm infants</u>	
Pain	Field, 2016, Chik
Sleep	Baniasadi
Growth	Alvarez, Zhang, 2019, Niemi, Taheri, Jabraeile, Li
Gastrointestinal function	Choi
<u>Full-term infants</u>	
Hyperbilirubinemia	Ahmadipour, Garg, Zhang, 2018
Colic	Sheidaei
Emotional availability	Porreca
Sleep	Field, 2017, Mindell

Table 2. Pediatric conditions and first authors.

<u>Condition</u>		<u>First author</u>
	<u>Behavior</u>	
ADHD		Chen
Aggression		Goncalves
	<u>Physical</u>	
Diarrhea		Gao
Asthma		Wu
Cystic fibrosis		Zink
Cerebral palsy		Rasool, Lu
Cancer		Rodriguez-Marsilla
Post-surgery		Weekly, Staveski

Table 3. Adult conditions and first authors.

<u>Condition</u>		<u>First Author</u>
	<u>Psychological</u>	
Postpartum stress		Jung
Couple's stress		Naruse
Postpartum anxiety		Parmar
Anxiety re: angiogram		Mei
Anxiety re: skin brushing		Ghezellah
Anxiety re: radiotherapy		Darabpour
Anxiety re: palliative care		Hsu
Generalized anxiety		Rapaport
	<u>Physical</u>	
Hemodialysis		Ahmadidarrehshima, Unal
Fatigue		McSween
Sleep		Kao, Kennedy, Ayik, Hsu, Rahmani, Cheraghbeigi, Sable
Post-burn		Nedelee, Ault
Hair thickness		Koyama
Constipation		Turan, Ruan, Dehghan, Momemfar
Dementia		Fung, Yang, Kapoor, Margenfeld
	<u>Musculoskeletal</u>	
Range of motion		Capobianco, Stefansson, Iwamoto, Akazawa, Yeun
Balance		Sankaran, Wikstrom, Tutun
Muscle activity		Nishimura, Domingo, Mohamadi, Molouki
Performance recovery		Nunes, Hoffman, Poppendiek
	<u>Pain relief</u>	
Labor		Abdul-Sattar, Unalmis Erdogan, Ranjbaron, Smith
Post-caesarean		Simonelli, Saatsaz
Joint pain		
• Knee		Tanaka, Efe Arslan, Nasiri, Perlman, Field, 2016
• Hip		Field, 2019
• Low back		Farber, Boguszewski, Daneau, Kumar, Buttagat, Joseph, Farber
• Elbow		Yi
• Neck		Celenay, Field, 2014
Disease-related pain		
• Dysmenorrhea		Vagedes
• Arthritis		Gok, 2016, Nelson
• Neuropathy		Gok, 2017
• Fibromyalgia		deOliveira
• Multiple Sclerosis		Backus
• Cancer		Lopez, Uysal, Boyd, Crawford
• Post-surgery		Pasyar, Massingill, Canyak, Koras, Silverdale, Boitor
Intensive care		Jagan
Palliative care		Pedersen
Residential care		McFeeters

Continuing to move up the body, range of motion has also been increased in the forearm (Kim, Hwang, Jung, Gwak & Kwon, 2019). In this study friction massage increased supinator muscle strength and helped restore limited range of motion of the forearm in supination. Range of motion has also been increased in the upper arm joints by massage therapy (Field, Diego, Delgado, Garcia, & Funk, 2013). In this study 40 participants were randomly assigned to receive moderate or light pressure massage therapy to their upper limbs. In addition, the therapist taught the participants self-massage and requested the participants to do the self-massage once per day for one month. Following a one-month treatment period, range of motion was greater in the wrist, elbows and shoulders. In a meta-analysis on massage therapy for the shoulder, seven studies covering 237 participants showed that massage therapy significantly improved range of motion in the affected shoulder, especially flexion and abduction (Yeun, 2017).

Balance. Studies from the recent literature suggest that massage has improved balance in stroke patients as well as patients with chronic ankle instability and those with type II diabetes. In a study on stroke patients, Ayurvedic massage (massage of the upper body by one massage therapist and the lower body by another therapist) was added to physical therapy and compared with physical therapy alone (Sankaran, Kamath, Nambiar & Kumar 2018). All patients received six hours of physical therapy over a one-week period and massage was delivered daily for a total of 10 sessions followed by steam application. The Ayurvedic massage group had faster standing with minimal assistance, greater balance and better locomotion which is not surprising given that they received not only physical therapy but also Ayurvedic massage and steam suggesting that both their pressure and temperature receptors were being stimulated.

In a study on patients with chronic ankle instability, three different types of treatments

were delivered including a clinician conducting manual plantar massage, a patient conducting self-massage with the ball and a clinician delivering sensory brush massage (Wikstrom, Song, K., Lea, A. & Brown, 2017). No differences were observed between these groups on postural control using single-legged balance with eyes open. The absence of group differences likely relates to all three groups receiving stimulation of pressure receptors in the feet. In a similar study but with patients who had type II diabetes, one leg standing tests with eyes open and closed were given following manual foot plantar massage (classic and friction massage) (Tutun Yumin, Simsek, Sertel, Ankarali & Yumin, 2017). Improvements in balance and functional mobility were noted following both types of massage therapy.

Muscle activity. Muscle changes have occurred following massage therapy including changes in the facial muscles, the trapezius muscle and the muscles of the forearm and hand. In a study using photograph-based scoring of massage-induced morphological changes, facial expression muscles changed following facial massage (Nishimura, Bender, de Menezes, Yamashitafuji, Vargas et al., 2017).

At least a few studies have focused on the trapezius muscle. For example, in a study on chair massage at a workplace, 15-minute massages were given twice a week for four weeks (Cabak, Kotnia, Banasinski, Obminski & Tomaszewski, 2016). That the trapezius muscles were most affected is not surprising given that the upper trapezius muscles are commonly associated with increased muscle tension and most chair massages are focused on the upper back region for that reason.

In a randomized cross-over study, muscle activity was recorded specifically from the upper trapezius muscles by surface electromyography (Domingo, Diek, Goble, Maluf, Goble et al., 2017). In one session moderate pressure massage was applied to the shoulders and neck and in another session the participants sat quietly. The moderate pressure massage led to

reduction in upper trapezius muscle activity suggesting that upper back pain and chronic neck pain may benefit from moderate pressure massage focused on this region. In still another study on the trapezius muscle, friction massage was applied to the trigger points in the upper trapezius muscle (Mohamadi, Piroozi, Rashidi & Hosseini, 2017). In this single-blind randomized clinical trial, participants were randomly assigned to a friction massage or a kinesiotaping group. Friction massage was performed daily for three sessions and kinesiotape was used for 72 hours. In contrast to the previous studies, trigger points in the upper trapezius were not affected, although grip strength increased significantly after friction massage. Grip endurance times have also increased following a single massage of the forearm and hand (Molouki, Hosseini, Rustaei & Tabatabaee, 2016).

Performance recovery. Massage therapy has been recently assessed to determine whether it facilitates recovery following physical activity including long-distance Ironman triathlons and ultramarathons. In a study on 74 triathlon athletes who completed the entire iron man triathlon race and whose main complaint was pain in the quadriceps, massage was applied to these muscles (Nunes, Bender, de Menezes, Yamashita, Vargan, et al. 2016). In this randomized, controlled trial with concealed allocation and blinded outcome assessors, the massage group was compared to a control group that rested in a seated position. Although there were no group differences on pressure pain thresholds, the massage therapy group had greater recovery from pain and perceived fatigue.

In another randomized controlled trial, participants in an endurance run were randomized to a 20-minute post-race massage, intermittent pneumatic compression or resting in a supine position (Hoffman, Badoski, Chin & Stuempfle, 2016). The massage resulted in lower muscle pain and soreness ratings than the ratings of the control group and both the

massage and the pneumatic compression groups had lower muscle fatigue scores likely because both protocols involved the stimulation of pressure receptors. That there were no differences between groups on any of the measures 1 to 7 days later was also not surprising given that the stimulation from the massage/pneumatic compression was not continued.

In a meta-analysis, 11 studies demonstrated that massage alleviated delayed onset muscle soreness after strenuous exercise (Guo, Li, Gong, Zhu, Xu et al., 2017). In another meta-analysis on 22 randomized controlled trials on massage for performance recovery, 17 studies used classic manual massage and five used automated massage (e.g. vibration) (Poppendieck, Wegmann, Ferrauti, Kellmann, Pfeiffer et al., 2016). Surprisingly, shorter massages (5-12 minutes) had larger effects than massages that lasted more than 12 minutes. And not surprisingly, the effects were larger for short – term recovery of up to 10 minutes than for recovery periods of more than 20 minutes. In addition, the effects after high-intensity mixed exercise were greater than those following strength exercise and endurance exercise. Further, untrained participants benefited more from the massage than trained athletes. Again, the authors were surprised by the short-term recovery effects as if expecting the effects to endure even though these were single, short massages. The effects would be expected to last only as long as the muscles were being stimulated. The greater effects of the shorter massage highlight the cost-effectiveness of massage being used for performance recovery.

Pain Relief

Massage therapy has been used most commonly for pain relief. This has included maternal conditions such as labor and delivery, joint problems including arthritis and disease-related pain as in, for example, cancer, post-surgical pain and pain in aging conditions including dementia. Recent studies in the

massage literature are grouped by these pain conditions in the following sections.

Maternal pain. Recent studies on the use of massage for maternal pain include labor pain and pain following Caesarean section. Labor pain is reputedly one of the most painful events in a woman's life (Abdul-Sattar, & Mirkhan Ahmed, 2018). In a study on labor pain, a back massage group was compared with a group that received frequent changes in position as a control group (Abdul-Sattar et al., 2018). The back massage group experienced less pain than the change in position group during the first stage of labor. In a similar study, lower back massage was compared to a control group at the end of the latent, active and transition phases of labor (Unalmis Erdogan, Yanikkerem & Goker, 2017). The massage group not only experienced less pain but also had a shorter delivery time and were more satisfied with the delivery.

Labor pain has been the focus of so many massage therapy studies that at least two meta-analyses have appeared in the recent literature. In the first of these, 10 studies were selected following inclusion and exclusion criteria (Ranjbaran, Khorsandi, Matourypour & Shamsi, 2017). The results showed that massage therapy reduced labor pain in the latent phase, the active phase and the transitional phase thus confirming the findings of the previous study. In a second meta-analysis, 14 randomized controlled trials were included (Smith, Levett, K.M., Collins, C.T., Dahlen, Ee & Sukanuma 2018). The results of this meta-analysis suggested that massage not only reduced pain but also reduced the length of labor and improved the women's emotional experience of labor.

Post-Caesarean delivery pain is another source of maternal pain that has been treated by massage therapy. In one study, connective tissue massage was used to reduce postoperative pain in women after Caesarean birth (Simonelli, Doyle, Columbia, Wells, Benson et al., 2018). In this study, participants were randomized to three groups including a group

that received a 20-minute massage, a group that received individualized attention and a group that received usual care. The massage therapy group not only had decreased pain but also decreased opioid use. In another study on post-Caesarean pain, the participants were randomly assigned to a foot massage group, a hand and foot massage group and a control group (Saatsaz, Levett, Collins, Dahlen, Ee & Sukanuma, 2016). The massage groups experienced a significant reduction in pain intensity as well as reduced blood pressure and respiration rate. A surprising finding was an increase in the frequency of breast-feeding following the massage. That may have related to reduced anxiety and/or increased relaxation. Although oxytocin was not measured, oxytocin often increases following decreased pain which, in turn, can facilitate breast-feeding.

Joint pain. Joint pain has been the subject of most of the massage therapy studies including lower back pain, knee pain, hip pain, elbow pain, shoulder pain and neck pain. This has probably occurred since pain is the primary presenting problem to massage therapists, making pain conditions convenience samples for research. Typically, the massage therapy has focused on the involved joint.

Knee pain. The diagnosis for knee pain is very often knee osteoarthritis. In at least four recent knee pain studies, massage has reduced pain and stiffness and improved physical functioning. In one study moderate pressure massage not only reduced pain at rest and during walking but also raised the pressure-pain threshold (Tanaka, Li, Gong, Zhu, Xu et al., 2018) In another knee pain study, aromatherapy massage was compared to conventional massage or to a control group (Efe Arslan, Kutluturkan & Korkmaz, 2019). The pain and morning stiffness were reduced and physical functioning was increased in the aromatherapy massage group. In another aromatherapy massage randomized controlled trial, massage with lavender oil versus massage with almond oil not only reduced pain but improved activities of daily living in a sample

with knee osteoarthritis (Nasiri 2018). It is not clear why adding an aroma would increase the effectiveness of massage unless it was contributing to relaxation.

In a multisite randomized controlled trial, full body massage was compared to light touch and usual care in adults with knee osteoarthritis (Perlman, Fogerite, Glass, Bechard, Ali et al., 2019). Following eight weeks of weekly 60-minute treatments, massage decreased pain and stiffness and increased physical function. However, at one year, the groups no longer differed, suggesting that the effects did not persist in the absence of massage. This was not surprising nor were the null effects for light touch as light touch does not have the positive effects of moderate pressure touch. Although light touch was once used as a control for massage, its arousing effects have not made it a suitable control group. In addition, in this study, it is not clear why full-body massages were given inasmuch as massages focused on the knee had been effective in previous studies (Field, 2016). In this review, massage therapy protocols were known to be effective not only for reducing pain but also for increasing range of motion specifically when moderate pressure massage was used and when both the quadriceps and hamstrings were massaged.

Hip pain. A recent report from the Center for disease control (2017) suggests that approximately 7% of US adults experience hip pain. Although exercise therapy and physical therapy have been used for hip pain, only one study could be found on the use of massage therapy for hip pain (Field, Sauvageau, Gonzalez & Diego, 2019). After a month of weekly 20-minute massages that were focused on the hip, the massage group versus a waitlist control group showed greater increases in range of motion and decreases in range of motion-related pain as well as less self-reported pain and sleep disturbances. The effects, however, were not sustained at a one-month follow-up assessment which was not surprising given that the massages were discontinued.

Low Back pain. Low back pain is the pain condition most frequently reported to massage therapists. Reputedly, low back pain is experienced by 70 to 80% of adults at some time in their lives and is one of the most common and costly musculoskeletal problems (Farber & Wieland, 2016). Various types of massage therapy have been used for chronic low back pain including Swedish, Acupressure, Ayurvedic and Thai massage. In a comparison between Swedish and Swedish plus acupressure, the latter protocol was more effective at reducing back pain (Boguszewski, Krupinski & Bialoszewski, 2017). Traditional massage has been assessed in a two session 30-minute massage during which lumbar paraspinal muscle activity was recorded using surface electromyography (Daneau, Cantin & Descarreaux, 2019). The results showed that self-reported pain was significantly reduced after the massage and those ratings were significantly correlated with lower back muscle endurance time.

Ayurvedic massage has been compared with local thermal therapy for low back pain. In Ayurvedic massage, essential oils are applied using tapping, kneading and squeezing as well as the more traditional massage stroking. In this randomized controlled trial, a two-week intervention of six hours of Ayurvedic massage versus six hours of thermal therapy, was compared at a two-week follow-up (Kumar 2017). Based on a 100mm visual analogue scale, the massage group showed a greater reduction in pain (54 to 22) versus the thermal therapy group (55 to 42).

Thai massage (a fully-clothed massage on a floor mat) has also been effective in reducing low back pain. In a single-blind, randomized clinical trial, participants were randomly assigned to receive a 30-minute session of either Thai massage or sham microwave diathermy (Buttagat, Narktro, Onsrina & Oibsamai, 2016). The Thai massage resulted in a greater reduction on an electromyogram detection of abnormal muscle electrical activity, on muscle

tension and pain intensity after one Thai massage session.

In a protocol that combined massage therapy with lumbo-pelvic stability training, the combination therapy was compared to a stand-alone massage therapy (Joseph, Hancharoenkul, Silitertpisan, Pirunsan, & Paungmali, 2018). The lumbopelvic stability training, which in itself has been effective, combines a number of exercises including hip abduction, knee raising and leg lifts from a supine position on an inflated air pressure biofeedback unit placed under the lumbar spine. In this randomized cross-over study, female weight lifting athletes with low back pain were randomized to three sessions of the combined therapy or massage therapy alone with 24 hours between sessions and a washout period of four weeks between the alternative therapies. The results showed that the combined therapy had significantly greater effects on reducing pain perception, increasing pain pressure threshold and increasing tissue blood flow. This result was not surprising given that the combined treatment was massage plus a form of self-massage resulting from the exercises on the inflated unit.

In a meta-analysis on 25 trials (3096 participants), massage was more effective than inactive controls for chronic low back pain in the short term but not in the long-term (Farber et al., 2016). Surprisingly, however, when compared to active controls, massage was more effective for pain reduction in both the short term and long-term. This is surprising inasmuch as massage has frequently been more effective than inactive controls but not when compared to active controls such as exercise (Field, 2016).

Elbow pain. Massage for elbow pain (alternatively called lateral epicondylitis or tennis elbow) has been compared with steroid injections in a randomized clinical trial (Yi, Bratchenko & Tan, 2018). Patients were randomized to receive splinting and stretching or a cortisone injection or a lidocaine injection with deep friction massage. The outcome measures were visual analogue scale pain scores,

disabilities scores and grip strength at early follow-up (six–12 weeks) and at a six-month follow-up. The measures improved for the cortisone injection group and the deep friction massage/lidocaine group at early follow-up, but at the six-month follow-up, only the patients in the deep friction massage group showed a significant improvement on all three measures. The long-term effects for the deep friction massage group suggests that they may have continued using self-massage to reduce their elbow pain. The deep friction massage effects are unfortunately confounded by the simultaneous lidocaine injection, a local anesthetic that would also be expected to reduce pain by numbing the tissue.

Neck pain. Neck pain has been the focus of at least two studies on massage therapy. In one of these 60 patients with chronic mechanical neck pain were randomly assigned to stabilization exercises with and without connecting tissue massage (Celenay, Bratchenko & Tan, 2016). After 12 sessions that were held three days per week for four weeks, the combined therapy was more effective than stabilization exercises alone in reducing pain intensity (on a visual analogue scale), increasing pressure pain threshold (using an algometer) and reducing anxiety (on the State Anxiety Inventory). In an earlier study, patients with neck pain received weekly massages for a month but were also taught self-massage so as to have a daily dose (Field, Diego, Gonzalez & Funk, 2014). The participants not only experienced significantly lower range of motion-associated pain but also showed greater range of motion.

Disease-related pain. Disease-related pain that has been treated by massage therapy in recent research includes dysmenorrhea, arthritis (both rheumatoid and osteoarthritis), neuropathy, fibromyalgia, multiple sclerosis and pain related to cancer. In most of these randomized clinical trials, pain reduction was based on self-report measures.

Dysmenorrhea. Reputedly, 20 – 90% of women suffer from dysmenorrhea (Vagedes,

Arikan Donmez, Izgu, Ozdemir & Arsian 2019). In a three – arm randomized controlled study two interventions were compared (a rhythmical massage once a week or heart rate variability biofeedback 15 minutes daily over a period of three months) (Vagedes et al., 2019). The rhythmical massage was more effective for reducing pain intensity and the dropout rate was higher in the biofeedback group.

Arthritis. In a randomized controlled trial, the study sample was randomly assigned to either an aromatherapy massage, a reflexology or control group (Gok Metin, & Ozdemir, 2016). The aromatherapy massage was applied to both knees for 30 minutes and the reflexology was applied to both feet for 40 minutes during weekly home visits for six weeks. Although both the massage and reflexology groups experienced less pain and fatigue as reported on visual analogue scales, the reflexology group showed decreases in pain and fatigue scores earlier than the aromatherapy massage group. This is perhaps not surprising since the reflexology sessions were longer and likely involved deeper pressure than the aromatherapy massage. This is another illustration of how treatment comparisons can be confounded by variables like the duration of treatment sessions and the amount of pressure applied.

In a recent systematic review on massage therapy for pain and function in patients with both osteoarthritis and rheumatoid arthritis, seven randomized controlled trials representing 352 participants satisfied inclusion criteria for this study (Nelson & Churilla, 2017). The results suggested low to moderate quality evidence that massage therapy was more effective than active therapies in reducing pain and improving functional outcomes. However, the effects for massage therapy versus other forms treatment were not as clear.

Neuropathy. One of the same groups that studied the effects of the aromatherapy massage on arthritis also studied aromatherapy massage effects on painful diabetic neuropathy (Gok Metin, Arikan Donmez, Izgu, Ozdemir &

Arsian, 2017). The aromatherapy massage group received massage three times per week for a period of four weeks and compared to a treatment as usual control group. Pain scores on two neuropathic pain scales suggested greater improvement in the intervention group by the fourth week of the study. The authors suggested that the essential oils rosemary, geranium, lavender, eucalyptus and chamomile could be safely used in clinical settings.

Fibromyalgia. In a recent study, patients with fibromyalgia were given massages twice a week for three months and responded to questionnaires including the Fibromyalgia Impact Questionnaire, the Perceived Stress Questionnaire and the McGill Pain Questionnaire and they also provided saliva samples for cortisol assays (de Oliveira 2018). By the third month, the massage therapy had improved scores on these questionnaires, although cortisol concentration values did not decrease. This study was limited by lacking randomization which might have revealed intervention/control group differences on cortisol levels over the 3 month period.

Multiple Sclerosis. Multiple sclerosis is a chronic, immune – mediated inflammatory disease that leads to fatigue, pain and spasticity (Backus, Manella, Bender & Sweatman, 2016). In a non-randomized pre-post pilot study, massage therapy was given one time a week for six weeks to 24 individuals with multiple sclerosis (Backus et al., 2016). At the end of the six week period the patients with multiple sclerosis had significantly less pain and less fatigue related to less pain given a significant correlation between the pain and fatigue scores.

Cancer-related pain. Significant pain has been associated with multiple forms of cancer. Massage has relieved symptoms in cancer patients and their caregivers. In a study on 343 cancer patients and 87 caregivers, the greatest symptoms were difficulty sleeping, fatigue and pain for the patients and sleep problems and pain for the caregivers (Lopez, Liu, Milbury, Spelman, Wei et al., 2017). The patients and

caregivers did not differ in regard to pain and sleep measures. Massage therapy was given for 30 to 60 minutes and was associated with statistically and clinically significant reductions in pain, fatigue, anxiety and sleep problems for both patients and caregivers. Greater massage duration (30 versus 60 minutes) did not lead to greater symptom reduction suggesting that even short massage sessions were effective. This is consistent with other reports suggesting that short massage sessions may be equally or more effective than long sessions (Poppendieck et al., 2016).

Colorectal cancer pain has been studied using classical foot massage and foot reflexology (Uysal, Rambod & Kahkhaee, 2017). In this randomized controlled trial the participants received classic massage during a five-week chemo radiotherapy treatment. The classical massage effectively reduced pain and distension while the foot reflexology was effective in reducing pain and fatigue as well as distension and urinary frequency.

In a meta-analysis of randomized controlled trials on cancer pain samples, 16 studies were included (Boyd, Crawford, Paat, Price, Xenakis et al., 2016). Massage therapy with effective for treating pain compared to no treatment groups as well as active treatment comparisons. Massage therapy was also effective for treating fatigue and anxiety when compared to active treatment groups in another meta-analysis on pain in general 67 studies were included in the review (Crawford, Boyd, Paat, Price, Xenakis et al. 2016). Massage therapy was more effective in reducing pain than sham, no treatment and active comparison groups in addition, massage therapy was beneficial for treating anxiety which likely rate related to pain.

Post-surgery pain. At least nine studies were found in the recent literature on massage therapy for reducing pain post-surgery. In one of these randomized controlled trials, a 10 minute foot massage (five minutes per foot) using sweet almond oil effectively reduced pain intensity and anxiety following tibial shaft fracture surgery

(Pasyar Rambod & Kahkhaee, 2018). In another randomized controlled trial, massage was used to reduce pain following surgery (Massingill, Jorgensen, Dolata & Sehgal, 2018). The massage group received 16 myofascial massage sessions over an eight-week period. The massage was focused on the affected breast, chest and shoulder areas. The control group received relaxation sessions over the same time period but avoided the affected breast, chest and shoulder areas. The intervention participants not only had reduced pain but also increased mobility after the eight-week treatment period. Pain following laparoscopic cholecystectomy has been studied a by two groups of investigators. In the first, patients were assigned to a 10-minute classic foot massage or a treatment as usual control group (Cankaya & Saritas, 2018). The intervention not only reduced pain but also nausea and systolic blood pressure. In another randomized controlled trial on postoperative pain following laparoscopic cholecystectomy (Koras & Karabulut, 2018), a positive relationship was found between pain intensity and state anxiety levels and foot massage again led to less pain intensity but also less need for analgesics. In a group that received radical cystectomy for invasive bladder cancer (an operation that is long and recovery is slow and painful), one hour of massage, reflexology or a combination of the two did not differ in their reduction of pain (Silverdale, Wherry & Roodhouse, 2019).

In two studies on pain reduction following cardiac surgery, massage has reduced pain intensity and anxiety. In a randomized controlled trial, patients were randomly assigned to two 20-minute hand massages, two 20-minute hand holdings (active control) or two 20-minute rest periods (passive control) (Boitor, Martorella, Maheu, Laizner & Gelinas, 2018). After controlling for baseline scores, the massage group reported significantly lower pain intensity and anxiety as well as decreased muscle tension. These data are not surprising given that

hand holding may be awkward for some participants and would unlikely involve moderate pressure. But having both an active and passive control group is a positive methodological feature of this study. In a review on seven studies assessing postoperative massage therapy effects in patients undergoing cardiac surgery, massage therapy was noted to decrease pain and anxiety (Grafton-Clarke, Grace, Roberts & Harky, 2018). Limitations of the studies included in this review were significant heterogeneity of the massage protocols and the failure in most to record analgesic or opioid requirements. In a meta-analysis, 16 randomized controlled studies were included for comparing massage therapy with other active treatments (Boyd et al., 2016). Although massage therapy was noted to reduce pain intensity/severity and anxiety in patients following surgical procedures, the effects were weak as compared to comparisons between massage and treatment as usual control groups.

Intensive care, palliative care and residential care. In a systematic review on 12 randomized controlled trials on massage for intensive care unit patients, there was a high level of evidence for positive effects on reducing pain and anxiety (Jagan, Park. & Papathanassoglou, 2019). The authors suggested that further research was needed on the effects of massage on sleep and on analgesic and sedative dosages. In a palliative care study, massage not only decreased self-assessed pain and anxiety but also reduced the need for rescue doses for pain and anxiety following only three massages per patient (Pedersen & Bjorkhem-Bergman, 2018). In a literature review on the use of massage in residential care settings, 14 studies met inclusion criteria (McFeeters, Pront, Cuthbertson & King, 2016). Based on the clients' perceptions, massage positively influenced pain, sleep, emotional status and psychosocial health. Additional evidence suggested a reduced need for restraints and pharmacological interventions.

Potential Underlying Mechanisms

One potential underlying mechanism that has been proposed for massage therapy effects includes the moving of skin, as in massage, stimulates pressure receptors that lead to a generally relaxed autonomic nervous system (Field, 2016). This includes physiological changes including decreased blood pressure and increased vagal activity as well as chemical changes that include decreased cortisol and increased oxytocin. These changes have been documented in the recent massage therapy literature reviewed here

Physiological Changes

Blood pressure decreases. Although most of the recent massage therapy studies have involved self-report rating scales almost exclusively, some studies featured physiological measures that very often confirmed the self-report data as well as indicated a relaxation in the autonomic nervous system. These were blood pressure measures in most cases including data from intensive care units, hypertension patients, coronary syndrome patients, COPD patients and those undergoing chemotherapy.

In a community-dwelling sample, aroma foot massages were given 12 times during a one month intervention period (Eguchi, Funakubo, Tomooka, Ohira, Ogino & Tanigawa 2016). Significant decreases were noted in systolic blood pressure and diastolic blood pressure as well as state anxiety, and the change in systolic blood pressure was positively correlated with the change in state anxiety.

In an intensive care unit study, only diastolic blood pressure decreased although sleep also improved following aromatherapy massage (Ozlu & Bilican, 2017). In another intensive care unit study, patients were given a 30 minute Swedish massage which reduced all vital signs including blood pressure, heart rate and respiratory rate as well as anxiety (Alves da Silva, Striari Schujmann, Yamada da Silveira, Caromano & Fu, 2017). Even the vital signs and stress levels have been decreased in intensive care nursing staff (Montibeler, Domingos, Braga,

Gnatta, Kurebayashi & Kurebayashi 2018). In this study, the nurses received six lavender aromatherapy massages which lowered their heart rate and blood pressure measures.

Systolic and diastolic blood pressure of course would be the primary measures in studies on massage therapy effects on hypertension and pre-hypertension. At least two studies have noted blood pressure decreases in hypertensive and pre-hypertensive women following massage therapy. In the study on prehypertensive women, massages were given for 10–15 minutes three times a week for 10 sessions (Givi, Sadeghi, Garakyaraghi, Eshghinezhad, Moeni, & Ghasempour, 2018). Both systolic and diastolic blood pressure significantly decreased at the end of the massage as well as 72 hours after the completion of the study, but there was no significant difference between the massage group and the control group after two weeks. In a meta-analysis on massage effects on blood pressure in patients with hypertension and pre-hypertension, nine randomized controlled trials met inclusion criteria (Liao, Chen, Wang & Tsai, 2016). Massage contributed to both a reduction in systolic and diastolic blood pressure.

Blood pressure measures have also been primary measures in studies on massage therapy effects on acute coronary syndrome. Other problems for those with acute coronary syndrome include other vital signs like arterial pressure, heart rate and respiratory rate as well as fatigue, anxiety and depression. In one study older female patients with acute coronary syndrome were randomly assigned to an aromatherapy massage, reflexology or a control group (Bahrami, Rejeh, Heravi-Karimool, Vaismoradi, Tadrissi & Sieloff 2018). The aromatherapy massage group experienced significantly reduced fatigue, systolic blood pressure, mean arterial pressure and oxygen saturation more than the reflexology group although the reflexology group experienced reduced heart rate more than the aromatherapy massage group. Surprisingly diastolic pressure was not affected by these interventions. In

another study by the same research group, a randomized controlled trial was conducted again on older women with acute coronary syndrome (Bahrami, Rejeh, Heravi-Karimool, Vaismoradi, Tadrissi & Sieloff, C.L. 2017). In this study, a reflexology with lavender group was compared to a control group who received routine care. In this case, both systolic blood pressure and diastolic blood pressure were decreased as well as mean arterial pressure and heart rate. No effects were noted for respiratory rate. In still another clinical trial, patients with acute coronary syndrome were assigned to a group that received hand and foot massage and compared to a treatment as usual control group (Alimohammad, Ghasemi, Shahriar, Morteza & Arsalan, 2018). The hand and foot massage were effective in decreasing anxiety levels and improving all vital signs.

Hand massage has also been effective at lowering blood pressure, heart rate, anxiety and pain in patients undergoing chemotherapy (Gensic, Smith & LaBarbera, 2017). Reductions were seen on all of these measures that were taken at baseline before 10 minute hand massages and after the chemotherapy session. A rare suggestion was made by the authors that family members and caregivers could be trained in this hand massage technique so that patients could receive this effective therapy before every chemotherapy session.

Pulmonary measures have also been used in this recent literature on massage therapy. For example, in a very recent scoping review, seven studies met criteria on massage in patients with chronic obstructive pulmonary disease (COPD) (Polastri, Clini, Nava & Ambrosino, 2019). In these studies, COPD patients who received massage therapy showed improvements in forced expiratory volume in one second (FEV1), as was earlier reported for children with asthma.

Vagal activity increases. As we have previously noted, massage therapy may have positive effects via increased parasympathetic activity and decreased cortisol or improved functioning of the hypothalamic-pituitary-

adrenal-cortical (HPAC) system. Several examples have been seen in this recent literature on how parasympathetic activity can be increased by massage therapy. Several types of massage have led to increased vagal activity that is also referred to as heart rate variability or parasympathetic activity. These different types of massage include hand massage, foot massage, head massage and body massage. In a study on hand massage comparisons were made between aroma hand massage and hand massage without aroma (Komori, Kageyama, Tamura, Tateishi & Iwasa, 2018). In this study parasympathetic activity increased following the aroma hand massage. In a foot massage study patients receiving cesarean delivery were given foot massages for 20 minutes after surgery (Xue, Fan, Ge, Zhang, Ge, Gu, et al., 2016). In this study heart rate variability increased as indicated by increased high-frequency power as well as a decrease in low-frequency power and the low-frequency to high-frequency power ratio. In addition all the vital signs decreased (respiratory rate, and systolic and diastolic blood pressure) as well as decreases in anxiety and pain intensity scores. In a head massage study each participant received both a head massage and a control condition in a randomized fashion (Fazeli, Pourrahmat, Liu, Guan, Collet, 2016). The control condition involves sitting quietly on the same chair with eyes closed. After a short 10 minute session total power increased and high-frequency power peaked at 10 minutes after the massage. In addition heart rate decreased more than three – fold after the massage as compared to the control condition. As the authors suggested, larger sample size, randomized controlled trials over multiple sessions are needed to corroborate these findings.

Rhythmical massage also improves autonomic nervous system function. A randomized, controlled trial involved three arms of the study including rhythmical massage with aromatic oil, rhythmical massage without aromatic or a standardized sham massage (Seifert, Kanitz, Rihs, Krause, Witt et al, 2018). Heart rate

variability increased in both rhythmical massage groups, although the heart rate variability increase was greater for the rhythmical massage with oil group. But after 24 hours the groups no longer differed. It is surprising that the participants in the study tolerated having Holter EKGs recorded for 24 hours. In another whole body massage study, Swedish massage was compared to stone therapy (placement of clay stones randomly on the body) (Hohl Deslandes & Marmora, 2019). Both therapies increased heart rate variability (the high-frequency power), although the Swedish massage with hand pressure was associated with more positive affective responses than the stone therapy.

In a study that combined massage with thermal therapy, university students were subjected to three different conditions on separate days including a control condition, massage only or massage with infrared heating (Kim, Lee, Schreiber, Im, & Kim, 2016). Massage therapy especially when combined with infrared heating significantly increased heart rate variability and decreased anxiety.

Another indicator of a relaxed nervous system following massage is increased alpha activity on EEGs. In a randomized cross – over study, group A received hand massage and group B received foot massage for 15 minutes each and then after a week group A received foot massage and group B hand massage (Nakano, Kodama, Ueda, Mori, Tani & Murata, 2019). Both the hand and foot massage led to resting – state alpha activity increases but in different areas of the brain. The foot massage led to increased alpha in the right and left posterior cingulate cortex and the hand massage led to increased alpha and left insular cortex. In both types of massage the participants reported relaxed feelings. These data are not surprising given that alpha is noted to increase during relaxed states with eyes closed.

Biochemical Changes

The biochemical changes that parallel the above physiological changes include decreased stress hormones including cortisol and alpha amylase,

increased oxytocin (the “love hormone”) and improved immune function (immunoglobulin A). In a study on patients with dementia, seven hand massages were given over three continuous weeks and salivary cortisol and alpha amylase assays were made (Schaub, Von Gunten, Morin, Wild, Gomez & Popp, 2018). After week two, significant decreases were noted in the hand massage versus the control group on both cortisol and alpha amylase levels. In a randomized controlled trial on aromatherapy massage effects on pregnant women, the intervention group received 70 minutes of aromatherapy massage with lavender oil every other week for 20 weeks (Chen, Chou, Yang, Tsai, Chang & Liaw, 2017). The pregnant women in the aromatherapy massage group had lower salivary cortisol and higher immunoglobulin A(IgA) immediately after the massage session. In addition, the pre-test IgA levels in the massage group were significantly higher at 32 and at 36 weeks than they were at 16 weeks gestational age. Increased oxytocin has also been noted after foot massage as well as increased activity in brain regions involved in social cognition and reward (Li, Becker, Wernicke, Chen, Zhang et al., 2019). In this study the participants received 10 minutes of foot massage either by hand or machine in a counterbalanced order and blood samples were taken before and after each massage condition for oxytocin assays. Plasma oxytocin increased after both hand and machine massage but the increases were greater after the massage by hand. In addition increased neural responses to hand versus machine – administered massage were found in the posterior superior temporal sulcus and medial/lateral orbito- frontal cortex (areas of the brain that are associated with reward).

Methodological Limitations

Many of the methodological limitations reported in an earlier review (Field, 2016) continue to exist in both therapy protocols and massage therapy measures in the literature reviewed here. Massage therapy has typically been

compared to a standard treatment control group. As massage therapy is increasingly noted to be therapeutic, an ethical question is whether a control group can be denied therapy. Increasing numbers of studies are therefore using waitlist control groups or comparison treatment groups. The waitlist control group would receive the same massage therapy at the end of the waitlist period. And treatment comparison groups would be given a similar therapy. The problem has been matching therapy protocols so they are not confounded by variables such as length of the treatment protocol, duration of treatment period, and pressure applied. So these comparisons have been confounded by a number of basic differences between the protocols. Massage has also been compared to simple touch and is more effective probably because of the movement of the skin.

When a therapy is added to massage therapy it sometimes has additive effects. For example, adding aroma to massage oils has been effective. The added therapy needs to be assessed as a group on its own. So, comparisons, for example, would be made between a massage group, an aromatherapy group and a group that receives both massage and aromatherapy. Other active therapies, for example, yoga and tai chi may have positive effects as they also involve stimulation of pressure receptors much like massage.

The massage research reviewed here as compared to that reviewed in 2016 (Field, 2016) has typically involved self-report measures even though measurement technology has become increasingly sophisticated. For example, in the earlier studies on breast cancer, immune measures were the primary measures, but in some of the recent studies on breast cancer, immune measures were not even reported. Gold standard medical measures have been used in some studies as, for example, blood pressure measures in hypertension studies and range of motion measures in arthritis studies, but most of the studies reviewed in this paper relied on self-report measures. It is not clear why this focus on

self-report measures has occurred as the reliability of self-report measures has been questionable. Their excessive use may in part relate to limited funding in recent years in this country and to limited funding in general in Asian countries where most of the massage therapy studies have been conducted. Ideally, research protocols would include psychological, physical, physiological and biochemical measures to document multivariable effects.

Pain syndromes continue to be the most frequently studied conditions, probably because the most frequent massage therapy clients are those with pain syndromes, highlighting the importance of that research. In contrast, some conditions that are also very prevalent in this country have not been assessed for massage therapy effects including obesity and diabetes (both conditions being NIH funding priorities) and drug use (a NIDA funding priority). Even though the growth of the massage therapy industry in the U.S. has been exponential, despite very limited insurance coverage for that therapy, relatively few researchers are studying massage therapy. Despite these problems with the literature, massage therapy is now considered more than just a complementary therapy and has been making inroads into more traditional medical settings.

Summary

In this review, massage therapy has been shown to have beneficial effects on many different groups and conditions. Although many of the studies have involved comparisons between massage therapy and standard treatment control groups, several have compared different forms of massage. Typically, the massage therapy groups have experienced more positive effects than the control or comparison groups, potentially because massage involves the stimulation of pressure receptors leading to enhanced vagal activity and reduced cortisol levels. Some of the researchers have employed physical, physiological and biochemical measures, although most of them have relied exclusively on self-report measures. Despite

these methodological problems and the dearth of research from the U.S., the massage therapy profession has grown significantly and massage therapy is increasingly practiced in traditional medical settings, highlighting the need for more rigorous studies.

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