



Massage therapy research review

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A B S T R A C T

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Moderate pressure massage has contributed to many positive effects including increased weight gain in preterm infants, reduced pain in different syndromes including fibromyalgia and rheumatoid arthritis, enhanced attentiveness, reduced depression and enhanced immune function (increased natural killer cells and natural killer cell activity). Surprisingly, these recent studies have not been reviewed, highlighting the need for the current review. When moderate and light pressure massage have been compared in laboratory studies, moderate pressure massage reduced depression, anxiety and heart rate, and it altered EEG patterns, as in a relaxation response. Moderate pressure massage has also led to increased vagal activity and decreased cortisol levels. Functional magnetic resonance imaging data have suggested that moderate pressure massage was represented in several brain regions including the amygdala, the hypothalamus and the anterior cingulate cortex, all areas involved in stress and emotion regulation. Further research is needed to identify underlying neurophysiological and biochemical mechanisms associated with moderate pressure massage.

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Massage therapy is one of the most effective and widely used alternative therapies. Although most massage therapy sessions are for pain, recent research suggests that it is effective for other conditions including growth of premature infants, ADHD, depression, and immune conditions, most especially cancer (see Field, Diego, & Hernandez-Reif, 2007 for a review) [1]. In this paper recent data are reviewed on massage therapy effects and potential underlying mechanisms for those effects.

Although this review does not cover all conditions that have been positively affected by massage, it is focused on some specific conditions for the following reasons: 1) moderate versus light pressure data are reviewed inasmuch as moderate pressure is critical for achieving the positive effects of massage, findings that are important to communicate to therapists and clients alike; 2) preterm infant massage data are reviewed because of preterm infants' need for supplemental stimulation such as massage therapy for optimal growth and development and the importance of conveying that to the medical community so that it can be adopted into practice; 3) pain syndromes are the most common presenting complaints to many complementary and alternative therapists such as massage therapists and to worker's compensation; 4)

attentiveness is critical for optimal school and job performance; 5) depression has negative effects on the immune system; and 6) the reduction of cortisol by massage therapy leads to increased natural killer cells and natural killer cell activity. Natural killer cells, in turn, ward off viral, bacterial and cancer cells, and in that way enhance immune function and reduce illness and disease.

1. Preterm infants

Our first massage therapy study focused on weight gain in preterm infants [2]. Since then, preterm infant massage has been noted to increase weight gain in studies from neonatal intensive care units in many parts of the world (see Field, Diego, & Hernandez-Reif, 2010 for a review) [3]. In most of these studies our 15-min protocol of moderate pressure massage (moving the skin) was used twice per day for a one-week period. After we documented preterm infant weight gain following massage in several studies, we reported data showing increased vagal activity and gastric motility, which could be leading to more efficient food absorption and increased weight gain [4,5].

In another study, we noted higher levels of insulin and IGF-1 growth factor when we compared a massage group who received three, 15-min massages per day for five days to a control group who received standard nursery care without massage therapy [6]. The massage group had greater increases in: 1) weight gain; 2) serum levels of insulin; and 3) serum levels of IGF-1. Weight gain was

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correlated with insulin and IGF-1 levels. Path analyses suggested that increased vagal activity was associated with increased gastric motility, which, in turn, was related to greater weight gain, and increased IGF-1 was also related to greater weight gain. The increased vagal activity during the massage contributed to 49% of the variance in the increased gastric activity. And, the increased vagal activity during the massage explained 62% of the variance in the increase in insulin levels. These findings suggested two potential pathways by which massage can increase weight gain: 1) insulin release via the celiac branch of the vagus; and 2) increased gastric activity via the gastric branch of the vagus [7].

Increased temperature is another potential underlying mechanism for the massage therapy effects on weight gain inasmuch as lower temperatures are associated with energy expenditure that could result in weight loss. Temperature was assessed in preterm neonates randomly assigned to a control or massage therapy group [8]. Temperature increased more in the preterm neonates receiving massage, even though the incubator portholes were open during the 15-min massage therapy sessions (which would be expected to lower their temperature). This likely resulted from the heat-producing effect of rubbing the skin.

Another group explored reduced energy expenditure as a potential underlying mechanism in preterm neonates receiving massage [9]. This research team used the same massage therapy protocol as the one used in our preterm infant studies. Their metabolic measurements by direct calorimetry suggested that energy expenditure was significantly lower in the preterm infants after a five-day massage therapy period than after a period without massage. This decreased energy expenditure may be in part responsible for the increased weight gain associated with massage therapy.

Moderate pressure was a critical factor for the weight gain effect. This was documented in a study in which we directly compared moderate (moving the skin) versus light pressure (light stroking) massage [10]. In that study, the moderate versus light pressure massage group gained more weight per day, and, as suggested, during behavior observations that followed the massage they showed significantly less: 1) active sleep; 2) fussing; 3) crying; 4) movement; and 5) stress behavior (hiccupping). They also had lower heart rate and greater vagal activity. All of these changes suggested lower arousal, which, in turn, could explain the enhanced immune function noted in preterm neonates following massage in a study on delayed-onset sepsis [11]. In that study, mothers massaged their infants on the face and limbs as well as passively exercised their upper and lower limbs four times a day. The incidence of delayed-onset sepsis was significantly lower in the massage group who also had a shorter hospital stay (by 7 days), which likely resulted from the lower incidence of sepsis. A potential pathway for the moderate pressure massage effects may be increased vagal activity, decreased cortisol, enhanced immune function and reduced sepsis. Inflated pro-inflammatory cytokines such as IL-1, IL-6 and TNF-alpha should also be measured for their contribution to sepsis and their potential reduction by moderate pressure massage.

Several follow-up studies across infancy have revealed significant developmental benefits for massaged premies [12]. Despite these positive effects of massage therapy on preterm infants, the incidence of preterm delivery would ideally be decreased. Inasmuch as there is a disproportionate incidence of preterm infants born to depressed women, massage was used as a prenatal intervention for those women in several studies. In at least 4 studies, massaging depressed pregnant women resulted in better neonatal outcomes (less prematurity and low birthweight) [13–16]. These effects likely derived from decreased levels of cortisol and norepinephrine resulting in lower intrauterine artery resistance.

Inasmuch as the uterine artery carries oxygen and nutrients to the fetus, the constriction of the artery could lead to prematurity and lower birthweight [1].

Full-term infants also benefit from massage. In one study, for example, full-term newborns who received moderate versus light pressure massage from their mothers gained more weight and had better development over the first month of life. [17] During the first several months, infants who are massaged have less irritability and sleep disturbance which are the most common complaints to pediatricians [1].

2. Pain syndromes

Massage has resulted in reduced pain in all the studies we have conducted on chronic pain conditions from lower back pain during pregnancy to labor pain, migraine headaches, premenstrual syndrome, chronic fatigue, fibromyalgia, carpal tunnel syndrome and rheumatoid arthritis [1]. In most of these studies the moderate pressure massage was focused on the painful area, such as the lower back, and the 20-min sessions were given twice per week for 5 weeks. In a recent review, the majority of the 25 studies that were covered employed a similar massage lasting 20–30 min and given twice-weekly over 5 weeks with assessments before and after the first and last session (at the end of the treatment period) [18]. These authors reported consistent single treatment reductions in salivary cortisol and heart rate and multiple treatment reduction in diastolic blood pressure (which has been recently replicated by Givi, 2013) [19]. Massage has also been effective for children and adolescents attending a chronic pediatric pain clinic [20]. After the therapy sessions, the children and adolescents reported significantly lower levels of pain, discomfort and depressed mood. In a study on postoperative pain management in adults, back massages resulted in decreased pain intensity as well as lower anxiety levels [21].

Arthritis patients have also experienced less pain following massage. For example, individuals with hand arthritis had less pain and greater grip strength following massage therapy [22] and even less pain when applying a topical analgesic following the massages [23]. Similar data have been noted for carpal tunnel syndrome [24], which were recently replicated by two studies using the same massage and measurement protocol [25,26]. Moderate versus light pressure massage has also been effective for rheumatoid arthritis in the upper limbs [27]. In that study entitled “Rheumatoid arthritis in upper limbs benefits from moderate pressure massage therapy” the adults with arthritis were randomly assigned to moderate or light pressure massage therapy groups. The participants were massaged on the wrists, arms and shoulders once a week for one month and they were also taught the massage and asked to massage themselves once a day. The moderate versus the light pressure massage therapy group had less pain and greater grip strength following the first and last massage sessions. By the end of the one – month massage period the moderate pressure versus the light pressure group had less pain, greater grip strength and greater range of motion in their wrists, elbows, and shoulders. Several studies on shoulder and/or neck pain, including one from our research institute, have yielded similar results [28–31]. A meta-analysis on 12 studies on neck and shoulder pain showed immediate and short-term effects for massage therapy [32]. And headaches associated with neck pain have also been reduced by massage therapy, although spinal mobilization techniques were more effective in that study [33].

Research on the lower limbs has focused on the knee. Massage outcomes have been positive for osteoarthritis of the knee [34] in which a dose response curve was noted with a plateau at 60 min per week. Pain has also been relieved by massage therapy following arthroscopic surgery for the knee in this case on a 20 min/week schedule [35].

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