The Graduate School
University of Wisconsin-Stout
Menomonie, WI

Author: Kimberly E. Goral

Title: ***The Effects of Massage Therapy on Autonomic Nervous System Activity, Anxiety, and Stature in Anxious Individuals.***

Graduate Degree/ Major: MS Applied Psychology

Research Adviser: Christopher Moyer, Ph.D.

Month/Year: Aug, 2011

Number of Pages: 45

Style Manual Used: American Psychological Association, 6th edition

Approved: 6 Semester Credits

Dr. Christopher Moyer

Committee Members:

Dr. Richard Tafalla

Dr. Debra Homa

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Abstract

Introduction: Massage therapy (MT) research has consistently shown that MT is effective in reducing anxiety; however the causal mechanism(s) of this effect is unknown. This study seeks to gain a further understanding of physical and physiological changes associated with the reduction of anxiety.

Method: Seven clinically anxious female college students between the ages of 18-26 completed the study. Participants attended a total of six sessions broken down to four MT sessions and two control sessions. Trait anxiety and attitude towards MT were measured prior to the start and immediately following the first and sixth sessions. State anxiety and stature were measured immediately before and after all sessions. Electrodermal (EDA) and heart rate, indicators of the sympathetic nervous system, were measured continuously during all sessions. Stature was measured before and after all sessions and compared to corresponding levels of anxiety. Stature and state anxiety were compared both within and across MT and control sessions.

Results: Trait anxiety was significantly reduced from the start to the completion of the study. State anxiety significantly decreased pre to post for both MT and control sessions. The decrease in state anxiety was significantly greater for MT sessions than control sessions. Heart rate decreased significantly more for MT sessions than control sessions. Electrodermal activity was significantly higher during MT sessions than control sessions. There were no significant difference pre-post differences in stature between MT and control sessions. There was a significant negative relationship between stature and state.

Discussion: Overall, results lend more support to the hypothesis that the reduction of anxiety from MT has more to do with physical/postural feedback than autonomic feedback to the brain.

Acknowledgements

I would like to thank my friends and family, especially Warren, for being so supportive of me on this adventure. This experience has been life changing, for the better. I'm thankful for the friends and colleagues I have met and had the pleasure of working with along the way. I am especially thankful for Meghan Thomason who performed all of the massages in the study in addition to helping with a number of other things including helping with measuring the stature photographs. I also want to thank my advisor, mentor, and friend Christopher Moyer, whom this whole experience and accomplishment would not have been possible without. Thank you to the other members of my thesis committee, Debra Homa and Richard Tafalla, for your constructive and supportive feedback on my project.

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Chapter I: Introduction

Anxiety disorders are the most common class of psychological disorders affecting people in the United States. Approximately 18% of adults in the United States are diagnosed with an anxiety disorder every year, with a lifetime prevalence rate of 28.8% (NIMH, 2009a; Kessler et al, 2005). Anxiety disorders are commonly linked to other psychological disorders and somatic diseases such as depression, substance abuse, and cardiovascular disease which can lead to poor health and further social dysfunction (Huang, Su, Tzeng-Ji, Chou, & Bai, 2009; Kessler et al, 2005; President and Fellows of Harvard College, 2011; Wittchen, 2002).

In addition to effects on the individual with anxiety, there is also a great cost to society (Kessler et al., 2005). Anxiety disorders cost the United States an estimated $46.6 billion per year, ranking as one of the most expensive psychological disorders to treat due to costs associated with decreased work production and increased use of health care services (Rosenblatt, 2010). For example, people with generalized anxiety disorder can be as affected as those with severe depression and often take days off from work for issues relating to their disorder. They are also more likely to seek primary medical care than those without anxiety (Wittchen, 2002).

Traditional first-line treatments for anxiety are psychotherapy, including Cognitive Behavioral Therapy (CBT) and Muscle Relaxation Therapy (MRT), and pharmacotherapy (NIMH, 2009b; Pluess, Conrad, & Wilhelm, 2008). However, the effectiveness of both psychotherapy and pharmacotherapy varies depending on several factors, and both types of treatment may present complications such as treatment non-compliance, high costs, and unpleasant side effects. Given the potential complications with current common treatments for anxiety, the discovery of new treatment options is desirable.

One potential treatment is massage therapy. Research has consistently shown that massage therapy (MT) can be effective in reducing anxiety (Beider & Moyer, 2007; Black et al, 2010; Gürol, Polat, & Akçay, 2010; Moyer, Dryden, Shipwright, 2009; Moyer, Rounds, Hannum, 2004). However, little is known about the causal mechanism behind the reduction of anxiety resulting from MT.

One of the most common theories is that MT first reduces cortisol, a stress hormone, which then lowers levels of anxiety (Field, Hernandez-Reif, & Diego, 2005; Field, 2008). However, more recent meta-analyses have failed to come to the same conclusions after re-analyzing the same data (Beider & Moyer, 2007; Moyer et al., 2004; Moyer, Seefeldt, Mann, & Jackley 2011). Therefore, it is unlikely that a reduction of cortisol causes a decrease in anxiety following MT.

Another theory centers on the autonomic nervous system (ANS). The ANS is comprised of two opposing branches: the sympathetic nervous system (SNS), which regulates the stress response, and the parasympathetic nervous system (PNS), which regulates the relaxation response. Heart rate and blood pressure, two physiological functions associated with ANS activity, have been shown to decrease following sessions of MT, which would be expected if MT was reducing SNS activity. It is theorized that this reduction may be the causal mechanism for the reduction of anxiety following MT (Bazzichi et al., 2010; Kaye et al., 2008; Moyer et al., 2004).

This current study seeks to test a new theory that massage changes a person's stature, or standing height relevant to an individual's posture, such that the feedback an individual receives from their body is inconsistent with feeling anxious. This hypothesis builds off of the James-Lange theory of emotion, which states that emotions are a result of physiological changes in the

body (James, 1890). More recent research shows that certain postures or expressions can cause changes in mood and emotion (Duclos et al, 1989; Wilson & Pepper, 2004). Muscle tension is one of the primary symptoms of anxiety and may put the body in a compressed state sending feedback to the brain that the person is anxious (American Psychiatric Association, 2000; Joorman & Stöber, 1999; Pluess, Conrad, & Wilhelm, 2009). Some research has shown that MT may reduce muscle tension (Hunter, Watt, Watt, & Galloway, 2006; Wiktorsson-Moller, Oberg, & Gillquist, 1983). It is possible that this effect may thereby alter the feedback that someone with anxiety receives by putting the body in a position that is incompatible with being anxious. Preliminary data supports this hypothesis as researchers found high, significant negative correlations between stature and anxiety levels (Moyer, Goral, & Burkett, in review).

Statement of the Problem

Anxiety is a large healthcare issue, affecting millions of people every year in the United States. Treatment success varies, and there are many complications that may come with the traditional first-line treatments of psychotherapy and pharmacotherapy, including treatment non-compliance, lack of effectiveness for certain people or disorders, and unpleasant side effects. Therefore, it is desirable to identify alternate or complementary forms of treatment.

Research on MT has shown promising results in the area of anxiety, and could potentially be an appropriate form of treatment. Studies show that MT consistently reduces levels of anxiety in both adults and children (Beider & Moyer, 2007; Moyer et al., 2004). However, the cause of this effect is unknown. If the mechanism(s) of effect could be identified, this information could be used to design maximally effective protocols for using MT to treat anxiety.

Purpose of the Study

The purpose of this thesis is to further investigate the effects of massage therapy on anxious individuals. A study by Moyer et al (in manuscript) looked at the effects of massage therapy on healthy, non-anxious subjects. Autonomic nervous system activation, including heart rate and electrodermal activity (EDA), as well as positive and negative affect, were measured in response to a series of four MT and two control sessions in a total of ten participants. Results showed that heart rate, EDA, and negative affect were significantly lower for MT sessions when compared to control sessions, indicating that MT may reduce these symptoms in healthy people. However, it is unknown if the same effects would be found in a group of clinically anxious participants.

To better understand the physical and psychological effects of MT in people with clinical levels of anxiety, measures of EDA and heart rate, along with anxiety itself, will be taken at each MT and control session in the current study. Electrodermal activity is commonly used to assess SNS arousal through measuring sweat gland activity by connecting electrodes to the hand and recording thousands of samples per second (Figner & Murphey, 2011). This allows for continual measurement that can be used to assess arousal patterns in an individual. Heart rate will be measured continuously with an electrocardiogram.

In addition, stature will be measured at each MT and control session. Reduced muscle tension may create a change in stature such that a person will be looser and less compressed, sending different feedback to the brain about their emotional state (Hunter et al, 2006; Wiktorsson-Moller et al, 1983). Changes in stature will be compared with changes in anxiety in the same manner as the previous research looking at this effect in order to gain a better

understanding of the relationship between stature and anxiety. This may shed more light on the phenomenon of posture and physiological feedback influencing emotion.

Research Questions

The overarching research question is the following: what changes are happening to or within the body that relate to a decrease in anxiety after MT? More specifically:

Question 1: How does the SNS respond to MT in anxious people?

Question 2: How does SNS activity vary according to MT on different areas of the body?

Question 3: How does an anxious person's stature or posture change as a result of MT?

Question 4: Does change in stature follow a trend in relation to change in levels of anxiety?

Hypotheses

The research hypotheses are as follows:

1. SNS activity will be significantly lower for MT sessions than control sessions
2. State anxiety will significantly decrease following MT in comparison to control sessions.
3. Trait anxiety will significantly decrease over the course of the study.
4. MT will change participants' stature such that they will stand significantly taller after MT sessions in comparison to control sessions.
5. Participants' stature will be significantly and negatively related to their level of anxiety, such that increased stature will correspond with decreased anxiety.

Chapter II: Literature Review

Traditional Treatments for Anxiety

CBT is one of the most common methods of psychotherapy in treatment for anxiety and is considered to be effective (Hoffman & Smits, 2008). However, treatment is not without potential complications. For example, the type of anxiety disorder as well as the motivation of the individual receiving treatment can greatly impact the success or failure of psychotherapy (Ritter, Blackmore, & Heimberg, 2010). Further, psychotherapy is not available in all areas, and can be expensive, even when covered by insurance, thereby limiting access for some people (Smith, 2003).

In addition to psychotherapy, pharmacotherapy is also considered a first line treatment for anxiety (Kolivakis, Margolese, & Ducharme, 2010). Medications such as selective serotonin reuptake inhibitors (SSRIs) and serotonin-norepinephrine reuptake inhibitors (SNRIs) are commonly prescribed to patients with anxiety. However, not all people respond well to medication and even for those who do, the results are often accompanied by unpleasant side effects such as headaches, gastrointestinal complications, and sleep disturbances (Kolivakis et al, 2010). Patients also are at potential risk for drug interaction effects if they are taking multiple medications, or may not be indicated for certain anti-anxiety medications because of another medication they are taking. Further, termination of treatment is also associated with certain risks and side effects such as chills, dizziness, sensory disturbances, panic attacks, or worsening of mood (Fava, 2006).

Muscle Tension and Anxiety

Increased muscle tension, a component of the autonomic nervous system's fight-or-flight response that prepares the body to react quickly, is highly associated with anxiety and is listed as

a symptom in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (American Psychiatric Association, 2000; Pluess et al, 2009). Sainsbury and Gibson (1954) compared muscle tension in participants with high and low levels of both tension and anxiety using electromyography and found that the higher the participants' subjective ratings of tension and anxiety, the more tension was actually present when measured in muscles of their forearm and forehead. In a more recent study of 183 students, researchers assessed the relationship between generalized anxiety disorder (GAD) and its six somatic symptoms and found that muscle tension was the most related of any physical symptom to chronic worrying, a characteristic of GAD which is the most prevalent type of anxiety disorder (Joorman & Stöber, 1999). As a result, different forms of muscle relaxation therapies (MRT) have been developed in order to treat anxiety.

Muscle relaxation therapy is another type of psychotherapy where patients are guided through a series of muscle relaxation techniques, such as progressive muscle relaxation. While it is not known exactly how MRT reduces anxiety, research has shown that MRT can be as effective as cognitive therapy (Conrad & Roth, 2007; Pluess, Conrad, & Wilhelm, 2008). One theory is that muscles are relaxed through a series of steps which leads to a decrease of anxiety. Another proposed theory is that MRT decreases anxiety through cognitive means, rather than actually decreasing muscle tension (Conrad & Roth, 2007). More research is needed to fully understand how MRT helps to reduce anxiety

Massage Therapy and Anxiety

Research in the field of MT has consistently shown that MT reduces anxiety (Beider & Moyer, 2007; Black et al, 2010; Gürol et al, 2010; Moyer et al, 2009; Moyer et al, 2004). In fact, the reductions of anxiety and depression are among the largest effects of MT documented.

Recent meta-analyses by Beider and Moyer (2007) and Moyer et al (2004) concluded that just a single session of MT can reduce state anxiety in children and adults. Multiple treatment sessions reduce trait anxiety in both children (mean effect sizes = 0.59 for first treatment and 1.10 SDs for last treatment) and adults (mean effect size = 0.37 SDs). These effects are similar to those observed in depressed and anxious individuals receiving psychotherapy for treatment, suggesting that there may be many parallels between psychotherapy and MT.

Despite the amount of evidence indicating that MT does indeed reduce anxiety, the causal mechanism behind this effect has not yet been identified. One often mentioned hypothesis is that MT reduces SNS activity and that this is one of the physiological changes that results in a reduction of anxiety (Bazzichi et al, 2010; Moyer et al, 2004). A study in 2008 indicated that indeed MT did decrease EDA, an indicator of SNS activity, more than just rest alone (Moyer et al, not published). In addition to SNS activity, heart rate also decreased an average of 1.53 beats per minute more during MT sessions than control sessions. These results support the hypothesis that MT reduces SNS activity; however more research is needed to further understand this effect.

A more recent theory is that MT changes a person's posture and the resulting feedback received from the body is incompatible with being anxious. This theory is based around the James-Lange theory of emotion which states that our emotions are a result of a combination of physical and physiological feedback from our bodies to our central nervous system. In other words, it may be possible or even likely that MT acts directly on the somatic nervous system to first reduce muscle tension, thereby changing an individual's posture and altering proprioceptive or bodily feedback to the brain and altering their emotion.

Two case studies looked at this theory in 2010. An anxious participant was recruited for each study and given a series of MT treatments. Participants completed the state portion of the

STAI and also had their photograph taken for assessment of stature before and after each session. Massages included a blend of Swedish and Deep Tissue techniques performed by professional, trained massage therapists and were not standardized across treatments or participants. Results of both case studies showed consistent decreases in anxiety and increases in stature following each MT session. Analyses of anxiety scores and changes in stature showed strong, nearly identical negative correlations (r = -.73, $p < 0.05$ and r = -.74, $p < 0.01$) such that as anxiety decreased, stature increased (M = 9mm and M = 14mm) (Moyer, Goral, & Burkett, in review). Limitations of these case studies include the small sample size (N = 2) and lack of a control group or non-MT control sessions. More research is needed to further test this theory and to see if this trend will emerge with a larger sample size.

Electrodermal Activity and Anxiety

Some research has indicated that there may be some individual differences in electrodermal measurement depending on anxiety level in normal subjects (Naveteur, 1987). Other research looking at clinically anxious subjects found that variables such as habituation, spontaneous skin resistance and electrodermal activity fluctuated in subjects with some types of anxiety disorders but those with generalized anxiety disorder did not differ from the non-anxious controls (Birket-Smith, 1993). Given this information, electrodermal activity should be a reliable indicator to measure SNS activity.

Variability of Stature

Human stature, or standing height, has a natural fluctuation both on a daily basis, as well as over time. Reilly, Tyrrell, and Troup (1984) sought to identify a circadian variation in intervertebral disc height that occurs during daytime compression and nighttime recovery periods. They built a frame specifically designed to measure stature and repeatedly measured

eight adult healthy, male participants (with heights ranging from 172 to 178cm) over a 24 hour period. They found a circadian rhythm for stature with a trough to peak difference of 19.3mm, which accounted for roughly 1.1% of the participants' overall stature. They found that the largest changes for compression and expansion occurred roughly three hours after waking in the morning (80% compression on average) and one hour after going to sleep (71% expansion on average).

In a later study, Krag, Choen, Haugh, and Pope (1990) also measured stature changes. Their participants included seven women and three men ranging in age from 20 to 39. Average female participant height was 160.4cm and average male participant height was 183.1cm. Participants were measured several times in horizontal and vertical positions. Results showed participants' stature decreased an average of 16.39mm after standing for eight hours, with 26% of this change occurring in the first hour. Participants were also measured after four hours of lying down and researchers found that they had regained an average of 13.57mm in stature, with 41% of this increase being obtained after just one hour.

Posture and Emotion

The idea that our emotions are a result of physiological feedback from our nervous system was first introduced in the 1800s by William James (1890) and Carl Lange (1885/1912). For example, in the case of anxiety, they would propose that anxious people first recognize their heart beating faster and their muscles tensing and the emotion would follow as a result of this bodily feedback. More recent research on posture, facial expressions, and emotion tends to support this theory that emotions are driven by proprioceptive and physiological feedback in the body.

For example, research by Duclos et al (1989) has shown that by simply changing one's posture or facial expression to mimic the stereotypic display of emotion can alter one's feelings to match. Duclos and her colleagues set up two experiments where they deceptively had people adopt various facial (experiment one) and postural (experiment two) expressions such as anger, fear, sadness, and disgust while performing an unrelated task. Participants were then asked to rate their experience of several different emotions, which were related and unrelated to the expressions they adopted. In both experiments, participants experienced the emotion that corresponded to their adopted expression more than any other emotion from the list of options, indicating that there was a strong connection between the physical expression and corresponding emotion.

Another study by Wilson and Peper (2004) looked at the effect of posture on the ability to generate positive or negative thoughts. They studied normal, healthy participants who were not being treated for a mental disorder. In their experiment, they had participants change between two different conditions. In the first position, participants were instructed to sit up straight, keep their heads up and close their eyes. In the second position they were instructed to slouch forward with their heads facing downwards and eyes closed. While in each position, they were asked to specifically think of a positive or negative memory and then rate the ease of generating the memory, the vividness of it, and how long they were able to hold it in mind, on a scale of one to ten. Results showed that positive thought were significantly easier than negative thoughts to generate in the upright position. Implications of this study are that posture can significantly influence one's ability to generate positive thoughts depending on posture.

Daryl Bem (1972) and James Laird (2007) expanded on the work and theories of William James, and described what they call the Self-Perception Theory. Bem asserted that our emotions

are a result of interpreting physical bodily cues, much like an outside observer. He stated that people must first learn associations between physical states and behaviors and emotions as children, and then refer back to them for information about how they feel later on. Laird added that in addition to the importance of recognizing body states, the context to which those reactions are taking place is also critical in identifying or creating emotions. The current study attempted to bring these theories and concepts together in an effort to better understand the reduction of anxiety resulting from MT.

Chapter III: Method

Ethical oversight

All procedures were approved by University of Wisconsin-Stout's Institutional Review Board, and participants gave their written consent prior to the commencement of research.

Participants and Recruitment

University students in psychology classes were given an opportunity to complete the trait portion of the State-Trait Anxiety Inventory (STAI), a 20-question self report survey designed to measure anxiety. Students were then given instructions to score their own tests. The normal trait anxiety scores for undergraduate college students are 38.30 for males and 40.40 for females (Spielberger, 1983). For the purpose of the study, a score of 50 was used as a cut-off point, where those scoring 50 or higher were invited to continue in the recruitment process. Fifty was determined to by a high enough score where students were likely to meet diagnostic criteria for an anxiety disorder while also being low enough to recruit an adequate sample size. Students who scored under 50 were thanked for their time and received research participation credits.

Those who wished to continue were scheduled to take part in a complete diagnostic interview with a licensed clinical psychologist using the Structured Clinical Interview for DSM-IV Axis I Disorders with Psychotic Screen (SCID I/P; First, Spitzer, Gibbon, & Williams, 2002). Students who fit our inclusion criteria (high levels of anxiety) and who also did not meet any exclusion criteria (interfering diagnoses such as manic or psychotic disorders) were invited to participate in our study.

Ten students from the recruitment process qualified who were also interested in participating further in the study. However, three of the ten withdrew from the study prior to completing all six sessions and therefore their data was excluded from all analyses. The

remaining seven participants were all Caucasian females, ranging in age from 18 to 26 (*M* = 20.14). Results from the diagnostic interview indicated that all seven participants had generalized anxiety disorder (GAD). Additionally, one participant had social phobia, and another had panic disorder without agoraphobia and a specific phobia (blood/needles). Four of the seven participants had previous episodes of depression; of these, one was in full remission, two were in partial remission, and one had a full recovery. Two participants reported never having received a professional massage prior to the study. The remaining five participants had experience receiving professional massage prior to the study, ranging from one to six sessions (*M* = 2.2).

Measures

Structured Clinical Interview for DSM-IV Axis I Disorders. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID I/P; First et al., 2002) is a diagnostic tool used to identify psychological disorders. The purpose of the interview was to diagnose participants' anxiety (if they met the guidelines), rule out co-morbid disorders, such as eating disorders, bi-polar disorder, substance abuse dependence, a tendency for violence or to harm themselves, or other psychotic disorders that could impact the study and also to ensure that potential participants received information regarding treatments that could be beneficial to them outside of the study. The SCID I/P was administered by a counseling psychologist with experience conducting this type of interview.

The State Trait Anxiety Inventory. The State-Trait Anxiety Inventory (STAI; Spielberger, 1983) is commonly used to assess anxiety in research and is a valid measure for anxiety. The STAI consists of two 20 question self-report surveys; one to measure trait anxiety, which assesses how a person generally feels, and one to measure state anxiety, which assesses how a

person feels in that moment. The range of possible scores for each portion of the STAI survey is 20-80, with a higher number indicating higher levels of anxiety. The trait portion was used for the initial assessment in the recruiting phase and also again at the completion of the final treatment session. The state portion was used during the study for pre and post anxiety measures at all six sessions. The STAI test-retest reliability for both portions is high (State α = .83-.92; Trait α = .86-.92; Dreger, 1970).

The Attitudes Toward Massage Scale. The Attitudes Toward Massage Scale (Moyer & Rounds, 2009) is a standardized measure that assesses a person's belief that massage is healthful and that massage is pleasant. In addition, participants' prior experience with professional massage was assessed. This measure was given to participants in the initial diagnostic interview and re-administered at the conclusion of the final treatment session.

Stature. Participants' stature, or posture, was measured for each treatment and control session. Changes in stature were assessed by calculating changes in standing height. A three foot by seven foot posture analysis grid from Kent Health Systems was used for measurement. The grid was mounted to the inside of a door in a fixed position with a weighted plumb line hanging from the ceiling approximately 18 inches in front of it to use as a guide for centering participants in front of the chart. Participants were photographed in front of the mounted chart using a digital camera that was mounted to a tripod several feet back from the chart and set at a specific level to ensure uniformity of photographs and measurement.

Postural photographs were coded and randomized by a member of the research team to blind other researchers who later measured them in order to prevent measurement bias. Photographs were then projected on a white dry erase marker board in random order. The pupil of the eyes was chosen as a marker for measurement as they were determined to be a location

that could consistently be located and measured with precision. The midpoint between the eyes was then established by marking the pupils of the eyes and measuring the distance between them, thereby providing a consistent, single measurement point for each photograph. This midpoint was then measured against the nearest line below the eyes on the postural analysis grid. Changes in stature based on this midpoint measure were assessed and recorded for each treatment.

Sympathetic Nervous System (SNS) Activity. Electrodermal and electrocardiographic activity (heart rate) were measured to assess SNS activation during all MT and control sessions through skin conductance using equipment from Biopac Science Lab (Biopac Systems, Inc. Model MP30B-CE). The electrodes used were also from Biopac Systems, Inc. (EL507 EDA isotonic gel electrodes). Two electrodes were placed in between the first and second knuckle on participants' first and middle finger of their non-dominant hand to record electrodermal activity. Two more electrodes were placed on the left side of the torso, about one to two inches superior to the iliac crest, and one electrode on the right shoulder, about one inch superior to the spine of the scapula, to record electrocardiographic activity. The feedback was recorded by a computer in an adjacent room (with cords and wires from the equipment to the computer passing through a small hole in the wall). Data was recorded continuously through each MT and control session and saved in separate files for each participant and each session.

Procedure

Participants were informed prior to the start of the study that they would attend a total of six sessions including four MT and two control sessions. They were told that the MT and control sessions would be randomized and they would not know which session they were receiving until after the session had started. In reality, the researchers pre-planned the order of the sessions as follows:

Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
MT	Control	MT	Control	MT	MT & Debrief

The deception followed the same protocol as the previous study assessing ANS activity and was planned in order to ensure that participants would attend all six sessions and not skip the control sessions if they knew that they would not be receiving a massage. Additionally, this planning made scheduling MT treatments with the massage therapist easier.

At the start of all six sessions, participants were asked to complete the state portion of the STAI and had their photograph taken for posture/height assessment. Photographs were taken in front of a posture analysis grid mounted to a door with a digital camera mounted on a tripod to ensure a uniform angle and picture location. Participants removed socks and shoes for photographs to eliminate the potential for changes in stature due to different footwear. Participants were then taken to the massage therapy treatment room where they were permitted to disrobe to their comfort level in private.

Once participants were settled on the massage therapy table, a trained researcher attached electrodes to five locations on their body to measure electrodermal and electrocardiographic activity. Participants then either received the massage treatment or control treatment depending on the session number. During MT treatments, the massage therapist was responsible for assisting the participants in turning over and checking to be sure the electrodes remained connected. The massage therapist was also responsible for removing the electrodes at the end of the MT sessions. During the control sessions, the researcher assisted the participant in turning over and unhooked the electrodes at the completion of the sessions.

After sessions were complete, participants completed the state portion of the STAI and again had their photograph taken in the same manner as before. Participants were then thanked

for their time and reminded of their next appointment time. Following the final study session, participants completed the trait portion of the STAI and ATOM scale in addition to the state portion of the STAI and had their photograph taken. Participants were then debriefed and had an opportunity to ask any questions that they had. All participants were given psychology research credits that corresponded to the amount of time they devoted to the study, whether they completed the study or not.

Treatment

All MT sessions were performed by a professional, trained massage therapist. The MT room was set up like a typical massage treatment room that an individual would encounter in the real world. Lights were dimmed during the sessions and classical, spa-type music was played. A professional massage therapy table was used for all sessions (Stronglite, Salt Lake City UT). The conditions were identical for both MT and control sessions. Participants were able to request firmer or lighter pressure according to their comfort and address any other concerns during treatment; however, they were asked to keep conversation to a minimum beyond necessary communication. Professional massage cream was used during all MT treatments (Pure Pro Massage Cream, Greenfield MA).

A specific 46-minute full body MT treatment protocol was standardized across all MT treatments and participants and consisted of a Swedish relaxation massage using mostly moderate pressure. A CD with a musical background and audio instructions played for all sessions. The instructions were specifically timed to ensure that each massage was exactly the same with regard to how much time was spent on each area. The protocol began with participants laying prone on the table without any massage for one minute. Participants then received thirteen minutes of MT on their back, followed by three minutes and thirty seconds to

each of their posterior legs. Participants then had one minute to roll over to a supine position and check to make sure electrodes were still attached. Participants then received three minutes and thirty seconds of MT to their left leg, followed by one minute and thirty seconds to their left foot. The same was done for their right leg and foot, followed by three minutes and thirty seconds to each of their arms. Finally, participants received six minutes of massage to their shoulders, neck, and head. During the final minute of the session, no massage was given.

Control Sessions

Control sessions were identical to treatment sessions with the exception that participants did not receive MT. All of the same measures were taken and participants were instructed to lie on the massage table for the same amount of time as the MT sessions, including turning over from prone to supine at the same time. Music and lighting were identical in all MT and control sessions.

Data Analysis

Anxiety

All state and trait STAI forms were scored appropriately and data was entered into a database using PASW Statistics 18. Paired samples *t*-tests were used to assess pre to post differences in state anxiety for MT and control sessions. State anxiety pre to post score differences were then calculated and compared between MT and control sessions using an ANCOVA. Trait anxiety was analyzed using a paired-samples *t*-test.

The Attitudes Toward Massage Scale

Scores for pre and post tests were calculated for each construct of the survey. Changes in attitude from the start to the completion of the study were calculated using paired a samples *t*-test for each construct.

Stature

Changes in stature were assessed for all MT and control sessions. These changes were then averaged to find mean MT and control changes. Paired samples t-tests were used to determine differences in change in stature for control and MT sessions.

Stature and Anxiety

State anxiety scores for all participants were paired with the corresponding stature measurement recorded at the same time. A Pearson's correlation was then used to identify relationships or patterns between anxiety and stature. All of the correlations were then averaged to identify a mean relationship between anxiety and stature.

Heart Rate

Electrocardiographic activity data was uploaded into Microsoft Excel and SPSS. Individual sessions were graphed in SPSS to find artifacts in the data. Artifacts were identified as extreme high or low spikes in the data for very brief periods of time (ranging from less than a second to several seconds) that were more likely due to movement than accurate ECG feedback and corrected to be in line with data immediately preceding and post ceding. Heart rates were averaged for control and MT sessions for each participant and across participants to receive a single mean heart rate for MT sessions and control sessions. A paired samples *t*-test was used to determine the difference in heart rate for MT and control sessions. After calculating a mean difference between MT and control session data, a 95% confidence interval was calculated and graphed.

Electrodermal Activity

Data was uploaded into Excel and SPSS. Data was graphed in SPSS and centered to align control and MT sessions in the same scale and to control for those whose skin had higher

conductivity. Control and MT session data were each averaged across participants in order to establish overall MT and control means. A paired samples *t*-test was then used to determine the difference in SNS activity for MT and control sessions.

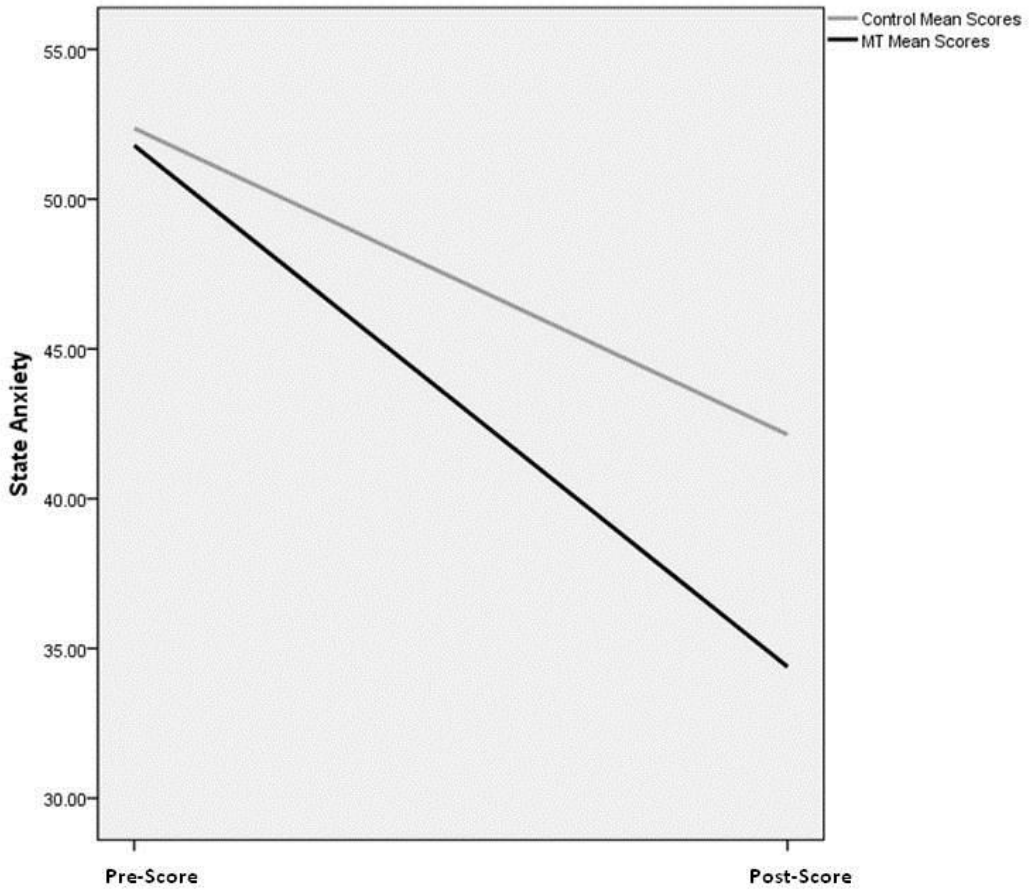
Chapter IV: Results

Anxiety

Trait anxiety was measured during the recruitment phase of the study and again following the final MT session. Trait anxiety was significantly reduced from before the start of the study (M = 59.14, SD = 2.01) to the completion of the study (M = 49.86, SD = 7.27) [$t(6) = 3.46$, p = 0.01].

State anxiety was measured immediately before and after each MT and control session. State anxiety was significantly reduced from pre to post for all MT [pre M = 51.79, SD = 6.63; post M = 34.39, SD = 1.88; $t(27) = 12.39$, $p < 0.001$] and control sessions [pre M = 52.36, SD = 2.60; post M = 42.14, SD = 1.99; $t(13) = 3.77$, $p = 0.002$]. The reduction of anxiety was significantly greater for MT sessions than control sessions [$F(1, 39) = 14.54$, $p < .001$]. Mean pre and post state anxiety scores for control and MT sessions are shown in figure 1.

Figure 1. Mean Pre and Post State Anxiety Scores



The Attitudes Toward Massage Scale

The ATOM Scale measured three separate constructs: Massage as healthful, massage as pleasant, and massage as arousing. The ATOM Scale was administered during recruitment prior to any treatment sessions and again following the final MT session.

Massage as Healthful: Scores of *massage as healthful* items were analyzed using a paired-samples t-test and showed that participants felt massage was significantly more healthful after completing the study (M = 18.29) than they did prior to the start of the study (M = 15.71) [$t(6) = 5.35$, $p = 0.002$].

Massage as Pleasant: Scores of *massage as pleasant* items were analyzed using a paired-samples t-test, however no significant changes were found between pre (M = 18.86) and post (M = 21) scores [$t(6) = 1.72$, $p = 0.14$].

Massage as Arousing: Scores from the one item looking at *massage and arousal* were analyzed using a paired-samples t-test and were not found to be significantly different from pre (M = 2) to post (M = 1.71) [$t(6) = 1.00$, $p = 0.36$].

Stature

Stature was assessed immediately prior to and after each MT and control session. On average, participants were 1.16mm (SD = 2.94) taller following MT sessions (M = 1532.98mm) than control sessions (M = 1531.82), however this difference was not statistically significant [$t(6) = 1.04$, $p = 0.34$].

Stature and Anxiety

Individual, corresponding scores of state anxiety and stature for each participant were paired and correlated. All of the correlations were then averaged to identify a mean relationship between anxiety and stature. The average correlation for all pairings showed a negative and moderately high relationship (r = -.50, p = 0.001).

Heart Rate

Heart rate (HR) was assessed during all control and MT sessions. On average, HR was 3.82 beats per minute lower during MT sessions (M = 74.51bpm) than control sessions (M = 78.33bpm). This difference was significant [$t(6) = 74.26$, $p < 0.001$]. A graph showing the MT and control mean HR data is shown in figure 1. Another graph with the mean difference between MT and control sessions, along with 95% confidence interval lines, is shown in figure 2.

The rollover period during the MT and control sessions is removed from both graphs due to the artificial artifacts in the data resulting from the movement.

Figure 2. Group Means for Heart Rate across Control and MT Sessions

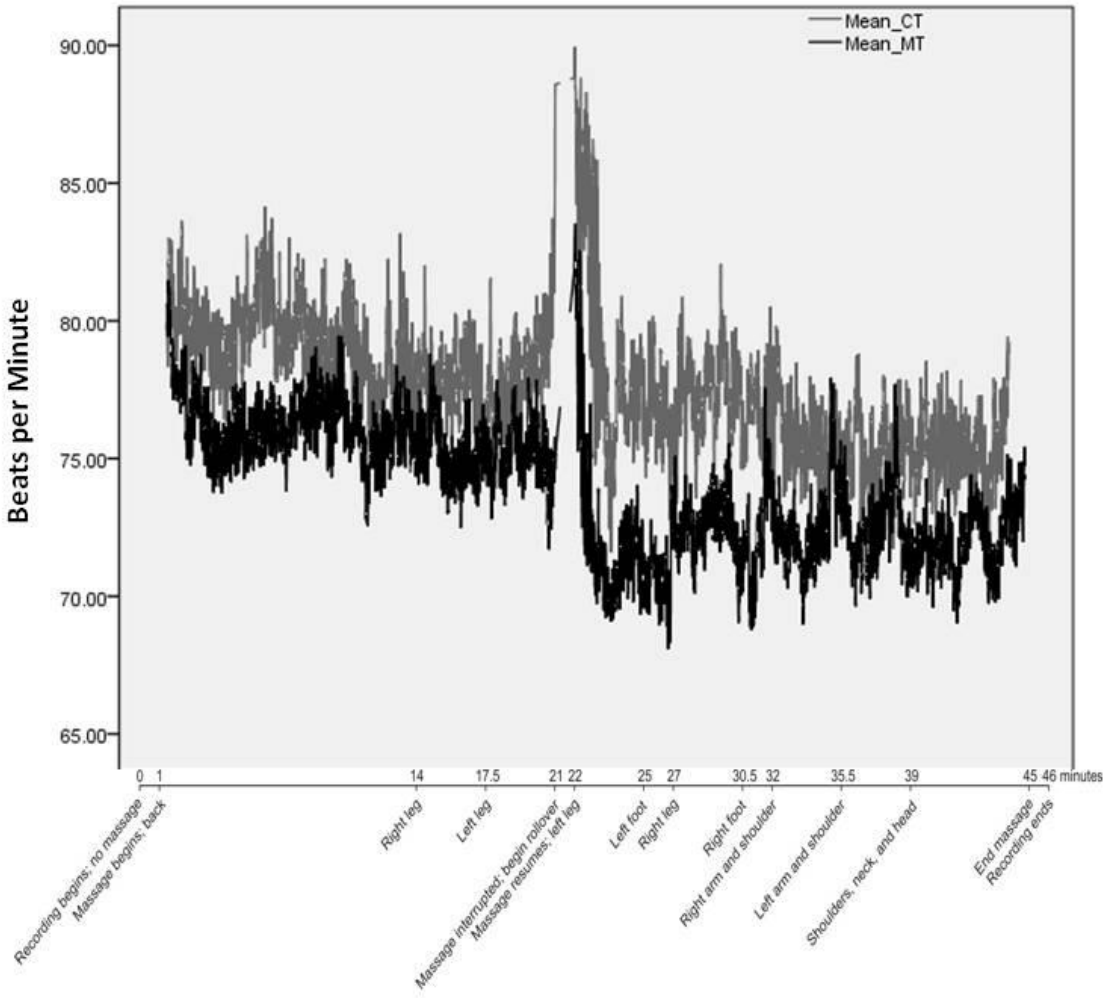
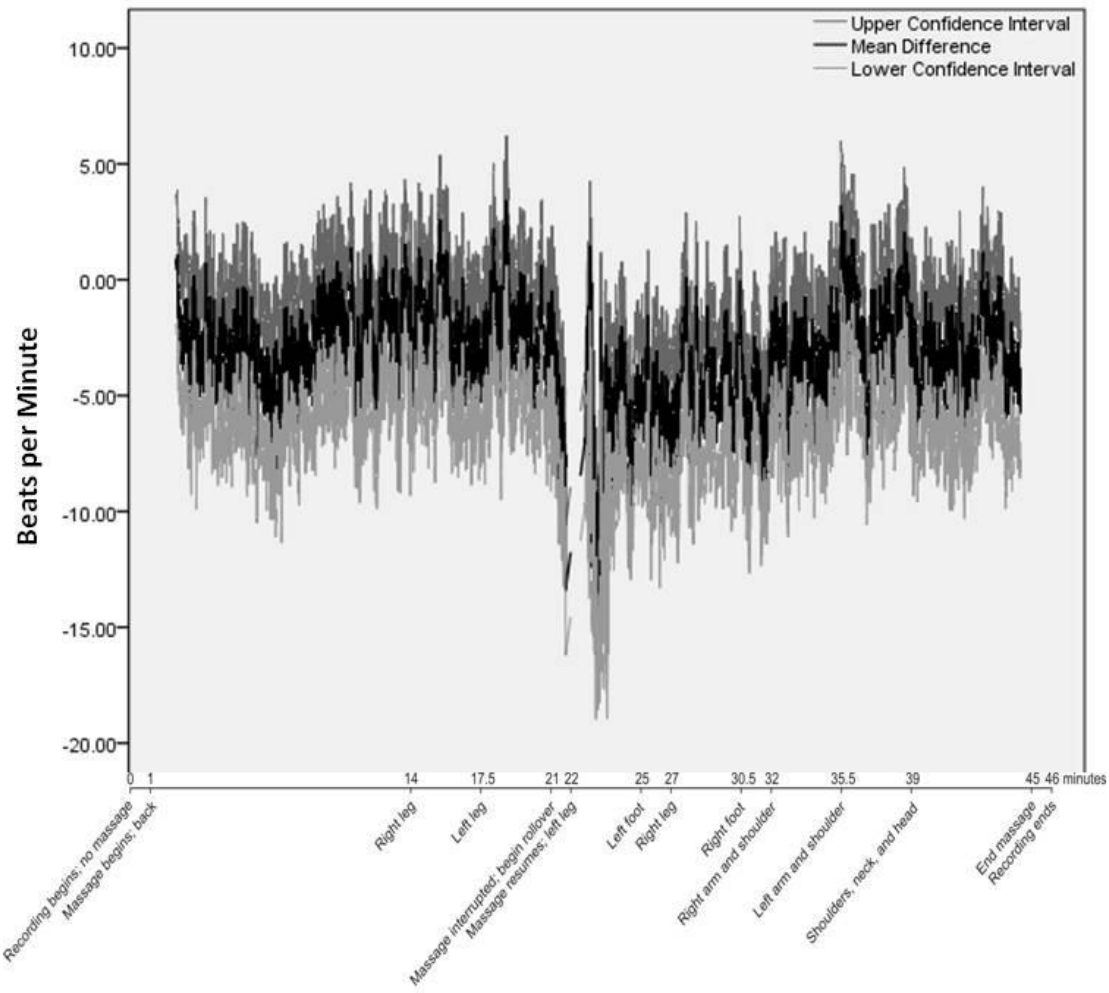


Figure 3. Mean Difference in Heart Rate between Control and MT Sessions with 95% Confidence Intervals: Heart rate is lower for massage group when mean difference is below 0bpm.



Electrodermal Activity

Electrodermal activity was measured continually during each MT and control session. Results showed that EDA activity was significantly greater for MT sessions (M = 6.48µmho) than for control sessions (M = 6.17µmho) [$t(6) = 31.29$, $p = 0.000$]. Graphs showing the mean activity for MT and control sessions as well as the mean difference between them with 95% confidence intervals are shown in figures 3 and 4.

Figure 4. Group Means for Electrodermal Activity across Control and MT Sessions

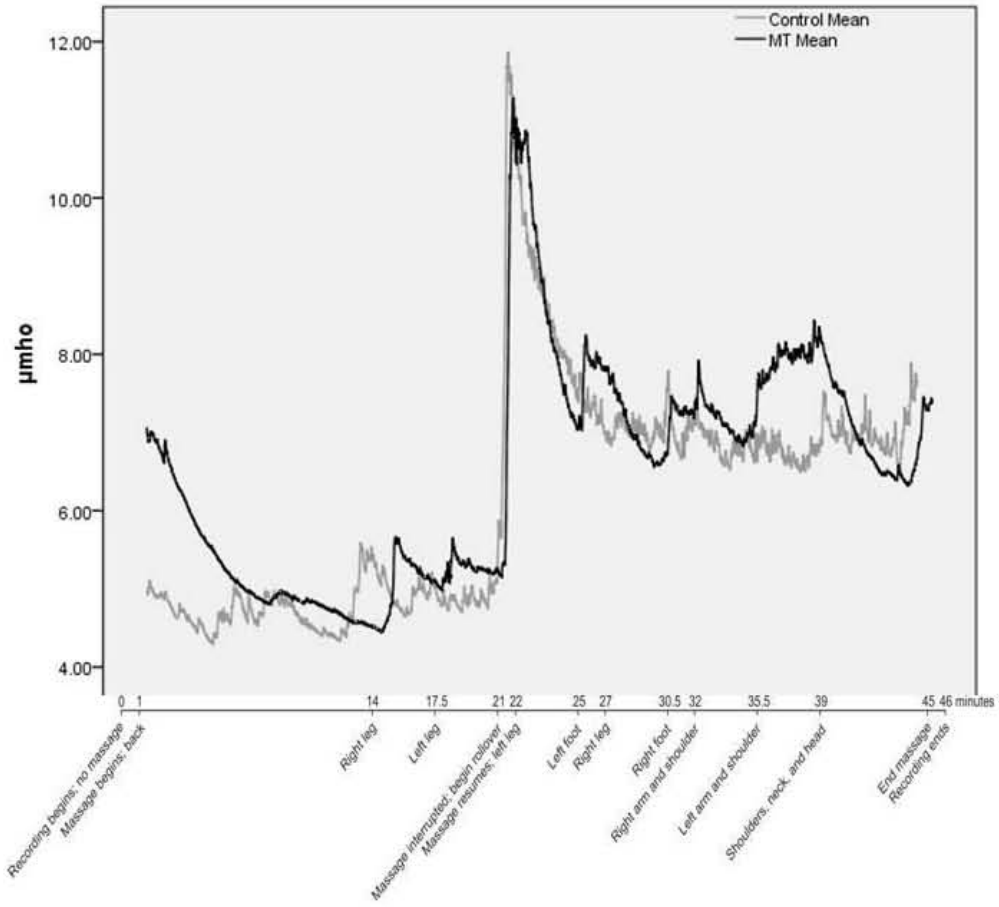
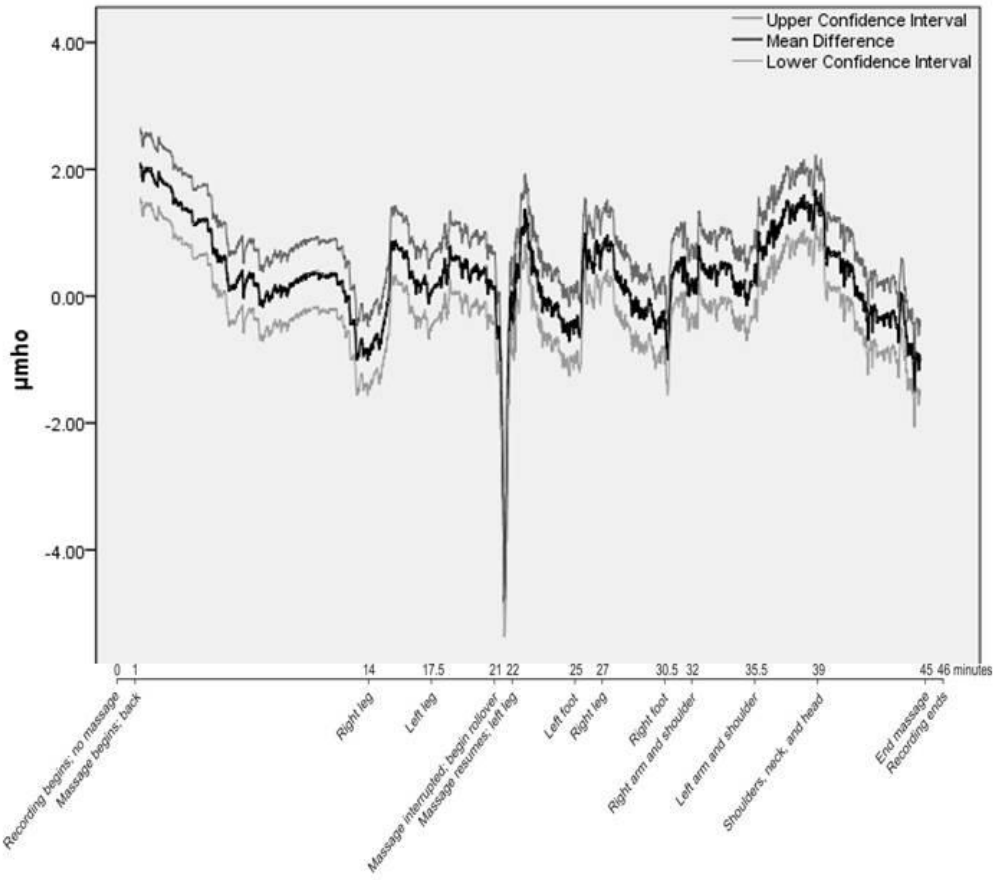


Figure 5. Mean Difference in Electrodermal Activity between Control and MT Sessions with 95% Confidence Intervals: EDA is lower for massage group when mean difference is below 0µmho.



Chapter V: Discussion

The purpose of this study was multi-faceted: The study sought to assess MT's effect on clinically anxious participants, and also to test the hypotheses that the reduction of anxiety is strongly related to 1) a reduction of sympathetic nervous system activity and 2) and change in stature, which could indicate a change in somatic feedback from the body to the brain. Seven clinically anxious participants completed the study where all participants experienced all MT and control sessions.

Decreases in both state and trait anxiety over the course of each session and the duration of the study respectively were expected and consistent with previous research.

The ATOM scale was used to assess participants' attitudes about MT with regards to it being healthful, pleasant, and arousing. Significant changes from before to after the study were only observed in the category of MT being healthful; however there are several potential reasons for the significant findings in this category and the lack of observed changes in the other two categories. First, people with limited familiarity with MT, as was the case for most participants, may not initially recognize MT as a healthcare treatment. Having the opportunity to experience several MT sessions would likely give them information from which to draw a more informed conclusion. Conversely, many people, even those with limited professional MT experience, recognize MT as being pleasant. Indeed, participants overall did rate MT as being pleasant prior to the start of the study. Therefore, there may have been a lack of significant change as expectations were met. Even still, the changes in the pleasant category may have been found to be significant in a larger sample size. Finally, participants did not recognize MT as being arousing overall even prior to the study and as a result there was not much room for change in that continued direction.

Heart rate decreasing from MT is a consistent finding in the literature and is also consistent with a previous study assessing SNS activity and MT in non-anxious participants (Beider & Moyer, 2007; Moyer et al 2004; Moyer et al, not published). In the previous study looking at this effect, heart rate decreased on average 1.53bpm more during MT sessions than control sessions. This physiological response is consistent with a decrease in SNS activity, however it was determined that EDA was actually greater for MT sessions than control sessions. This was the direct opposite of what was expected, based on the theory that MT reduces anxiety by decreasing SNS activity as well as the previous study assessing SNS activity with MT. This finding is very interesting for many reasons. It appears that MT may affect anxious and non-anxious people differently. Further, if SNS activity is higher than PNS activity during MT for anxious people, then it seems unlikely that the ANS is responsible for the decrease of anxiety.

One possible explanation for this finding is that the healthy, non-anxious participants were all experienced with massage (having each received several massages in the few years prior to the study) whereas some of the anxious participants had never received massage and of those who had, all but two had received two or fewer massages in their lifetime. Receiving a first massage ever, or even the first couple of massages by a new therapist, can be an anxiety-inducing experience. However, typically as it becomes more familiar, it can become more comfortable and less stressful. It would be interesting for further research to track if the ratio of SNS:PNS activation changes in anxious individuals as they gain more experience with MT.

Nonetheless, even though EDA was significantly higher for MT sessions than control sessions, anxiety did still significantly decrease in each session, indicating that there is still a major change happening independent of changes to the SNS. This again lends support to the theory that changes have more to do with somatic feedback than autonomic feedback. It could

be possible, then, that decreased SNS activation is a downstream effect of reduced anxiety, rather than the causal mechanism. The reduction in HR may have been the first sign of this effect.

Analysis of the change in stature did not reveal a significant difference between MT and control sessions. However, it is possible that this was due to the small sample size which decreases statistical power and the likelihood of finding a true difference. Further research would be needed to reach a stronger conclusion. The correlation between stature and anxiety was moderately high giving further evidence to the theory that there is a strong relationship between change in stature or posture and change in anxiety. These findings are in line with previous findings from two case studies looking at the same relationship. While in the correlation between stature and anxiety was slightly lower for the current study (r = -.50, p = .01) than the previous case studies (r = -.73, $p < 0.05$ and r = -.74, $p < 0.01$), it is still strong evidence to support an existing significant relationship and also warrants further exploration.

Limitations

As with most studies, this one was not without limitations. The biggest limitation for this study was the small sample size which was due to funding and time constraints in addition to the number of participants who dropped out prior to completion (n = 3). A larger sample size would allow for real differences or changes to become apparent, as in the current study there are a few that based on available evidence, it seems that real differences should exist that were not found. Having a set MT protocol and only using one therapist for all treatments could be viewed as a limitation as these can decrease external validity of the study because in the real world, there are hundreds of thousands of different massage therapists in the United States and it is unlikely that one would receive an identical massage at every session. However, the treatment protocol and only using one therapist is also a strength as it increases internal validity by introducing fewer

variables into the study. Further, use of one therapist and a MT protocol was viewed as necessary for practical reasons such as the need to train the therapist in the protocol, for scheduling purposes, and helping to ensure confidentiality of study participants.

Conclusion with Recommendations for Future Study

Overall, support for the hypotheses was mixed. The most interesting findings, perhaps, are that EDA was significantly higher for MT sessions while anxiety still decreased, and the relationship between stature and anxiety was still fairly strong in this larger sample size. Both of these findings lend further support to the theory that the causal mechanism behind the reduction of anxiety is due more to somatic feedback rather than autonomic feedback, which is in line with early and modern theories of emotion.

Psychologists and physiologists from James (1890) and Lange (1885/1912) to more modern findings of Bem (1972), Duclos et al (1989) and Laird (2007) have theorized that human emotions are a result of physical and physiological feedback from the body to the CNS. Many studies have shown that by manipulating facial expressions to full body postures can induce otherwise unexplainable emotions, supporting these theories. Further, the reduction of muscle tension from MT could put the body in an altered physical state, resulting in a change in stature or posture. This change could send different signals to the CNS indicating signs of relaxation rather than tension and anxiety. Based on the available information, both previous and from the current study, it seems that the most likely explanation for the reduction of anxiety resulting from MT is that MT changes a person's posture such that their new physical feedback is incompatible with being anxious, and this feedback is received in the CNS. However, more research is needed to further explore this theory and reach a stronger conclusion.

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