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Original Papers

Measurement of Regional Cerebral Blood Flow Associated with the M Technique–Light Massage Therapy: A Case Series and Longitudinal Study Using SPECT

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Abstract

Objectives: The aim of this 2-study research project was to measure the physiologic effect of the M technique (see Appendix for description) on the brain using single photon emission computed tomography (SPECT) and compare it to conventional massage therapy.
Methods: In the first study, 4 participants received 1 M technique session. Each participant was injected through the intravenous cannula (IV) with 7 mCi ^{99m}Tc and scanned using SPECT before the M technique session, and then was injected with 25 mCi ^{99m}Tc through the IV and scanned using SPECT after the M technique session. In the second study, 1 participant received 10 conventional (Swedish) massages and one participant received 10 M technique sessions. Both participants were injected and scanned (using the identical scanning parameters as in Study 1) before, and immediately after, their 1st and 10th sessions. Baseline and 1st, and baseline and 10th sessions were compared using paired *t* tests.
Results: Although the activation changes were positively correlated for the M technique and massage participants ($r = 27$, $p < 0.05$), when activation changes around the 1st and around the 10th sessions were compared (using paired *t* tests), significant differences emerged. There were significant activation changes for the M technique participant [$t(64) = 2.32$, $p < 0.05$): In particular, there was a 40% activation change and directional change in regional cerebral blood flow in the right caudate, which was not seen in the massage participant. The precuneus showed an approximate 15% reduction in activation changes around the M technique session for both the 1st and 10th treatment, but not for the massage participant.
Conclusions: These findings suggest that the M technique and conventional massage may both elicit blood flow brain activation changes; however, the participants' responses did differ. The M technique revealed greater changes (particular in the right caudate), and these responses increased when the M technique was repeated over time (unlike massage). These findings have implications for future research into the potential mechanism of the M technique in the treatment and care of patients.

Introduction

The M technique is a patented method of gentle, structured stroking that was created more than 10 years ago by a critical care nurse/massage therapist specifically to reduce stress and anxiety in patients too fragile to receive conventional massage (see Appendix for details). It is currently being used in approximately 40 hospitals in the United States and in 12 hospices in the United Kingdom. Although there are no published clinical trials, over 200 individual case studies plus a case series and several pilot studies indicate that the M Technique (M) can reduce anxiety in the critically ill, and reduce perception of chronic pain and/or agitation in the actively dying.[1] A randomized, controlled study in a neonatal intensive care unit showed infants who received 10 minutes of M technique required less analgesia, had better

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blood oxygenation, and were less distressed following circumcision.[2] Similar unpublished studies ($n = 20$ and $n = 12$) suggest that the M technique can reduce agitation at the end of life.[3,4] Physiologic changes associated with the M technique using electrocardiogram monitoring demonstrated a rapid and substantial change in heart rate variability on continuous tracings of 5 volunteer participants (M. Oz, personal communication, 1998).

Over 200 case studies suggest that the M technique elicits a profound relaxation response in the "healthy but stressed" adults; the effect has been likened to hypnotherapy or deep meditation. Meditation has been shown to affect EEG activity[5] and brain function.[6] Meditation has also been shown to affect cerebral blood flow[7–11] In a recent review, Ernst et al.[12] wrote that mind–body therapies now have accrued a sufficient body of evidence to support their claim for positive impact on health and relaxation. We felt that the M technique could be perceived as a form of physical hypnotherapy or physical meditation.

At the time of our study, we were not aware of any other studies utilizing cerebral blood flow neuroimaging techniques on participants undergoing massage techniques. Since then, Ouchi et al.[13] have published their work on cerebral blood flow with and without massage using positron emission tomography (PET). They found that the regional cerebral blood flow (rCBF) increased in the precuneus, and that levels of both stress-related cortisol and salivary stress protein chromogranin-A were reduced with light massage.

Both studies in the present research program used ^{99m}Tc-bicisate single photon emission computed tomography (SPECT) imaging to study the changes in brain function of those receiving the M technique. Increased rCBF shows up as red > yellow > green > blue on the scan. SPECT analysis was chosen instead of PET and functional magnetic resonance imaging (fMRI) because PET measures cerebral glucose metabolism and would take up to 30 minutes. This would mean that the point of relaxation could not be captured. Alternatively, fMRI includes loud, sudden noises that would make relaxation difficult; thus SPECT was chosen at the method best able to capture "naturalistic" unconfounded brain activity.

Study 1 examined the effect of a single administration of the M technique in 4 naïve participants. Study 2 compared the activation changes between the 1st and 10th session (1 treatment session per week over 10 consecutive weeks) in the M technique and compared them to the activation changes between the 1st and 10th session in the massage participant.

For both of these studies, the following hypotheses were formulated:

1. Key regions of brain activity, such as the sensory system would increase rCBF because of increased afferent traffic subsequent to the application of touch in all participants.
2. It was further hypothesized that the M technique would elicit the same, or greater activation, change compared to traditional massage. These hypotheses will be addressed in Study 1 and Study 2, respectively.

Methods

Design overview

The research program entails 2 studies ($n = 4$ and $n = 2$, respectively). A convenience sample of healthy volunteers was used to explore the physiologic effects of touch on the brain rCBF using SPECT.

Participants

Six (6) healthy female volunteers were recruited. In the 1st study, 4 female nurses (aged 21–52) took part, and received 1 M technique session. One (1) was African Caribbean and 3 were white. In the 2nd study, 2 white female nurses (aged 52 and 32) were recruited, 1 to receive 10 M technique sessions over a 10-week period and 1 to receive 10 massage sessions, also over a 10-week period. Two different but equally qualified therapists gave the M and the massage sessions. None of the participants had a history or clinical evidence of medical or neuropsychologic illness, nor drug abuse that would potentially alter cerebral blood flow. The participants had never experienced the M technique. None had any experience with meditation, but 1 had some yoga experience many years previously and 1 prayed regularly. None was clinically depressed: Depression can reduce glutamate in the anterior cingulated cortex.[14] All participants were asked to keep their eyes closed and relax to avoid any autonomic arousal that could bias the study.[15] The participants in both studies reported minimal discomfort from the intravenous cannula (IV), but it was resolved prior to initiating the remainder of the study.

Procedure for imaging acquisition

After obtaining informed consent, as approved by the Human Institutional Review Board, a participant was brought to a treatment room. She lay in the supine position on a gurney while an IV was placed in 1 arm at least 20 minutes prior to the baseline scan. The participant rested on the gurney with her eyes closed and ears unoccluded for 10 minutes. At the end of this time, her shoulders were gently pressed. She smiled (thereby indicating she was awake) with her eyes closed (to avoid any visual stimulus) and was immediately injected through the IV with 7 mCi of ^{99m}Tc-bicisate (Amersham International, Arlington Heights, IL, prepared as specified by the manufacturer). Thirty (30) minutes following the injection, she was scanned for 45 minutes in a Picker-Prism (Picker Inc., Cleveland, OH) triple-headed rotating gamma camera using high-resolution fanbeam collimators. Projection images were obtained at 3° angle intervals on a 128 × 128 matrix (pixel size 3.56 mm × 3.56 mm) over 360° by rotating each head 120°. These SPECT images were reconstructed in the transaxial, coronal, and sagittal planes using filtered backprojection, followed by a low-pass filter and 1st-order Chang attenuation correction (attenuation coefficient set to 0.11 cm^{-1}). The reconstructed slice thickness was 4 mm with a spatial resolution of 8–10 mm.

In the first study, after the "baseline" scan, the participant returned to the treatment room to undergo the M technique. She lay in the prone position on a hospital gurney while the M technique was applied in a standard manner (back, back of legs). Then she turned over so she was in the supine position to receive the face, head, shoulders, hands, arms, front of legs and feet M technique. After completion of the M technique, she remained in the supine position, keeping her eyes closed and her ears unoccluded. Her shoulders were then gently pressed. She smiled to indicate she was awake with her eyes closed. Immediately, she was injected with a second dose of

approximately 25 mCi ^{99m}Tc-bicisate through the IV (this is the moment when the "picture"—the SPECT scan was taken) while she remained lying supine on the gurney. She remained lying on the gurney undisturbed for 15 minutes. Afterward, she was removed to the scanning room for a "post M" scan that lasted for 30 minutes (using exactly the same imaging parameters as for the baseline). Values were obtained for regions of interest (ROI) in major brain structures and normalized to whole brain activity. The percentage changes between the pre- and post-M technique scans were compared. Correlations between structures were also determined.

In the second study, 1 participant received 10 weekly M technique sessions and 1 participant received 10 weekly massage sessions. Both M technique and massage participant were scanned before and immediately following the 1st and before and immediately following the 10th M technique (or massage session). Exactly the same SPECT procedure was used as described above (7 mCi of ^{99m}Tc-bicisate before the 1st and 10th M technique or massage, and 25 mCi ^{99m}Tc-bicisate following the 1st and 10th M technique or massage. The activation changes pre and post the 1st and the activation changes pre and post the 10th sessions were compared for both M technique and massage participant. The scores were correlated and plotted for comparison, as will be described below.

Image analysis and statistics

1. *ROI analysis*. The images of the baseline and M technique scans were reconstructed and resliced, using an oblique reformatting program, according to the anterior–posterior commissure line so that the final 2 sets were at comparable anatomical sites for the analysis. A previously validated template methodology using ROIs that corresponded to the major cortical and subcortical structures was placed over the baseline scan.[16] Changes between the baseline and post M scans for the first study ($n = 4$) were compared using paired t tests with correction for multiple comparisons for each of the regions in the atlas. These results are presented in Table 1: rCBF and discussed in the Results section. An analysis of the laterality indices for each homologous pair of ROIs in the baseline and M scans was performed using a 2-tailed Student's t test.

2. *Correlations between brain structures*. Pearson correlations were generated to assess the association between changes in rCBF values in different regions. Significance tests for the correlations were limited to the structures of the posterior superior parietal lobe, dorsolateral prefrontal cortex, thalamus, midbrain, and sensorimotor cortex since these were the areas that would most likely interact with each other as the result of the M technique. Because of the small sample size ($n = 4$ and $n = 2$, respectively), all results were confirmed using Spearman correlations (to account for the nonparametric nature of the data). However, as the results of both methods were similar, only Pearson correlations will be presented (for ease of understanding effect size).

To obtain the activation change data points for the 2 participants in Study 2, "difference scores" were computed for each participant, in order to control for baseline measurements. This meant calculating the activation change from the baseline and immediately after the 1st session, versus the activation changes from baseline and immediately following the 10th session. In this way, a high score for both of these variables indicates an increase in brain activity (controlling for the baseline) and a low score indicates a decrease in activity.

Results

Study 1

In Study 1, there was little change observed around the first session of the M technique for any of the brain ROIs, and the mean value for most regions was less than 10%. The laterality index was also not significantly different in any of the ROIs (Table 1: rCBF).

Study 2

In Study 2, there were significant activation changes for the M technique participant, from before the 1st to immediately after the 10th activation score [$t(64) = 2.32$, $p < 0.05$] whereby the *df* reflect the areas of the brain assessed: In particular, there was a 40% activation change and directional change in rCBF in the right caudate (Fig. 1). The 40% activation change in the right caudate is indicated by a green arrow). There were no significant activation changes for the massage participant over the course of the 10 weeks. The precuneus activation was not altered between the 1st and 10th sessions, but did show an approximate 15% reduction in activation around each M session but not with massage (Fig. 2). In Study 2, ordered graphs were first used to examine hypothesis 2 regarding the activation change between the first and the 10th sessions in the M technique participant compared to the activation change between the 1st and 10th sessions in the massage participant (Fig. 3). In order to compare the 2 participants, their activity change from baseline was plotted side by side. The *Y* axis indicates increased (positive) or decreased (negative) blood flow and activation following week 10 (controlling for the initial baseline). The areas of the brain were ordered from a decrease in activity to an increase in activity for the massage participant in black, and contrasted with the increased and decreased activity for the M technique participant in gray. Not all brain regions tested are labeled on the *X* axis in order to simply illustrate the overall pattern of comparative activation. In other words, the brain regions are ordered on the *X* axis from the areas showing the greatest decrease in blood flow and activation to those showing the greatest increase.

Sixty-five (65) areas of the brain were measured. The M technique participant had 16 areas of the brain with >20% activation change, compared to 10 areas in the massage participant, and 35 areas with >10% change compared to the 27 in the massage participant. The M technique participant also had 42 areas with a change of direction of rCBF from positive to negative, or negative to positive compared to 31 changes in direction of rCBF in the massage participant. The overall differences in brain regions are presented in Table 1: rCBF. As described in the correlation and graphing methods above, we compared the changes in the M technique participant versus the massage participant, examining their change from the 1st session to the 10th session (controlling for the baseline). It should be noted that the activation change in each of the brain regions was positively correlated for the 2 participants ($r = 0.27$, $p < 0.05$).

There were participant differences that were measurable with statistical analyses and imaging techniques and observable in the graphing techniques. With regard to t tests,

Table 1. Assessing the Difference Between Baseline and Post "M" Regional Cerebral Blood Flow Based on Region of Interest (ROI) Analysis in Study 1

Region name	*Mean activation*	*Standard deviation*
Rt. ant. cinculate	3.77	7.65
Lt. ant. cinculate	3.69	6.14
Rt. dorsal medial cortex	1.71	4.95
Lt. dorsal medial cortex	−1.04	2.44
Rt. DLPFC	3.99	5.12
Lt. DLPFC	1.43	1.89
Rt. sensorimotor	−0.06	6.75
Lt. sensorimotor	3.16	2.11
Rt. sup. temporal	0.79	6.93
Lt. sup. temporal	0.19	5.42
Rt. supramarginal	1.72	3.03
Lt. supramarginal	0.15	5.95
Rt. caudate	−1.05	14.93
Lt. caudate	1.55	16.56
Rt. thalamus	1.90	4.90
Lt. thalamus	8.98	3.95
Rt. lat. vis.	−0.48	8.51
Lt. lat. vis.	5.61	8.52
Rt. med. occip.	3.32	8.63
Lt. med. occip.	−0.99	5.96
Rt. parietal	4.89	5.14
Lt. parietal	3.08	6.84
Rt. inf. frontal	3.95	4.43
Lt. inf. frontal	−0.54	2.35
Rt. globus pallidus	−4.78	19.75
Lt. globus pallidus	0.38	6.22
Rt. putamen	4.25	13.78
Lt. putamen	6.08	13.90
Rt. hippocampus	2.82	3.54
Lt. hippocampus	1.79	5.31
Rt. cerebellum	9.23	10.70
Lt. cerebellum	10.03	10.09
Rt. midbrain	9.96	18.58
Lt. midbrain	9.62	7.58
Rt. orb. front.	2.03	3.93
Lt. orb. front.	2.99	10.09
Rt. rectal	7.65	11.89
Lt. rectal	4.29	13.73
Rt. amygdala	−1.35	12.06
Lt. amygdala	−3.18	10.54
Rt. occ.-temp.	6.71	8.60
Lt. occ.-temp.	9.18	6.92
Rt. precuneus	−2.54	18.03
Lt. precuneus	−2.72	4.94
Rt. sup. frontal	2.22	4.19
Lt. sup. frontal	3.84	4.15
Rt. sup. parietal	3.79	4.01
Lt. sup parietal	2.39	2.97
Rt. inf. temp.	3.99	9.03
Lt. inf. temp.	3.02	6.72
Lt. medial frontal	2.57	3.60
Rt. medial frontal	0.05	4.70
Rt. temp. pole	−2.42	5.98
Lt. temp. pole	−0.33	5.95

Rt., right; Lt., left; ant., anterior; DLPFC, dorsolateral prefrontal cortex; sup., superior; lat., lateral; vis., visual; med., medial; occip., occipital; inf., inferior; orb., orbital; front., frontal; temp., temporal. Changes were compared using paired *t* tests with correction for multiple comparisons for each of the regions in the atlas. An analysis of the laterality indices for each homologous pair of ROIs in the baseline and post M scan was performed using a two-tailed Student's *t* test. Changes in right caudate and precuneus are highlighted.

there were significant differences for the M technique participant, from the 1st to the 10th activation score [$t(64) = 2.32$, $p < 0.05$, whereby the *df* reflect the areas of the brain assessed]. These changes, from the initial baseline to final post-treatment, were not seen in the massage participant [$t(64) = 1.61$, $p > 0.05$].

Discussion

While there was little change in the first study (when the M technique was delivered once), there were significant activation changes in the M technique participant in the second study, over and above those seen with the massage participant. Furthermore, the cumulative effects of 10 sessions of the M technique and massage appeared to be different: In the massage participant, the areas affected were much smaller and had a different distribution. Figure 3 (bar chart) shows a lack of change for the massage participant whereby the change from baseline rarely reaches an increase greater than 0.2 or a decrease greater than 0.2. However, there is a significant difference for the M technique participant. This is further supported by the significant *t* test findings of activation change for the M technique. Taking Hypothesis 1, we expected a 10% increase in rCBF in key regions of brain activity and in Study 2 this occurred, but there was also a 40% activation change in the right caudate plus a change in direction of rCBF. This is interesting, as in a recent study by Beauregard (2006) the right caudate was activated in Carmelite nuns when they were in a "state of union with God".[17] In another study, Kjaer et al.[18] found that meditation resulted in a 65% increase in endogenous dopamine release. The right caudate is highly innervated with dopamine neurons. Therefore, it could be hypothesized that the 40% increase in the right caudate (produced by the M technique) might result in an increase in dopamine release, which could lead to a meditative-like state.

There was also an activation decrease of approximately 15% in activity of the precuneus area from baseline to post M technique (Fig. 2), which did not change between the 1st and the 10th session (see blue arrow in Fig. 1). This decrease is far greater than in the massage participant. This is of particular interest because the precuneus is thought to act as a default area of the brain. Raichle and Snyder[19] found that certain areas of the brain had a reduction in rCBF during goal-directed activities. This was contrary to what was expected. Moreover, these areas did not have reduced evidence of activation when the participants were resting. From this evidence, the authors suggested that there is a "default mode of brain function" supporting an equilibrium that enables long-term neural activity and blood flow. The posterior cingulate and precuneus were two such areas of the brain that behaved in this way: no increase under activity and no reduction at rest. It was suggested that this balancing facility enabled the resting brain to actively gather information about the external and internal world. So it is particularly interesting that the M technique appeared to affect the precuneus more than conventional massage did.

Any data from a single patient must be considered preliminary, however, if the findings were replicated in other studies, they may have important implications for understanding the mechanism of the M technique. This would be consistent with the research of Miall and Roberts,[20] which supports the default theory that the default area of the brain

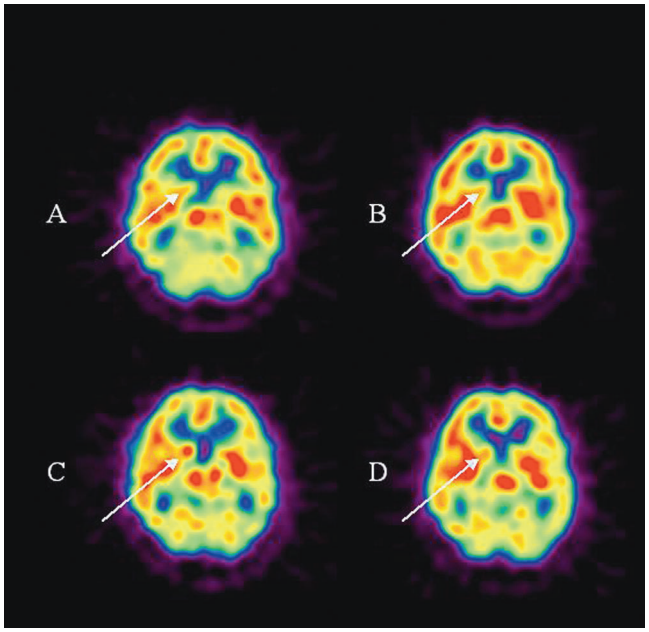

FIG. 1. Single-photon emission computed tomography of M technique and right caudate. This figure shows transaxial slices of the brain to show the right caudate. The figure compares the pre and post 1st M technique with pre and post 10th M technique. **A.** Pre 1st M. **B.** Post 1st M. **C.** Pre 10th M. **D.** Post 10th M. Cerebral blood flow is shown as red > yellow > green > blue. There is a 40% activation increase plus directional blood flow change in the right caudate (indicated with the arrows).

is active when the brain is at rest. In a review by Cavanna and Trimble,[21] it was stated that a reduction in activity (hypometabolism) of the posteromedial cortex (precuneus) occurs in altered conscious states such as sleep (slow wave and rapid eye movement), hypnosis, and anesthesia as well as in goal-related activities. Rainville et al.[22] found that hypnosis reduced rCBF in the precuneus. Macquet et al.[23] thought a reduction in rCBF in the precuneus was important for altered state of consciousness.

It could be hypothesized that the M technique allows a deep relaxation. Such a deep relaxation is normally only available during sleep, hypnosis, or meditation. In our study, the M technique participant was clearly awake because she gave an immediate physical response to a physical stimulus (she smiled with her eyes closed when her shoulders were pressed) immediately prior to the second injection. However, following the procedure she did state that she felt as though she had "floated in and out of consciousness." This concurs with comments the primary investigator (PI) has received over the last 12 years: that the effects of the M technique are deeply relaxing but are very different from those of conventional massage. Participants state that they feel they are in a "deep state of meditation, or an altered state of consciousness where the world just goes away."

Although both of our studies consist of a small number of participants, it is appropriate to consider potential explanations for these findings to assist in the generation of hypotheses for further study. The results seen in the initial 4 patients were somewhat unexpected, because each patient reported feeling more relaxed at the end of the M technique administration. There are several possible explanations for the initial lack of findings. All scans occurred after the completion of the treatment, when the participant was in the resting state. It might be argued that we should have at least seen mild changes that have been associated with an overall sense of relaxation. There are 2 possible explanations: that the initial effect on the brain was not large enough to be detectable using current techniques, or that the effect was relatively short lived and therefore was no longer present by the time the radiopharmaceutical was injected.

By amending the original protocol to explore whether there was any measurable effect after a period of "training the brain" (10 treatments over 10 weeks), we were able to show a significant effect in the M technique participant. While the small number of patients limits our ability to specify the ROIs that may be specifically related to the use of the M technique, the consistent finding of a detectable difference in the before–after comparison following a period of "brain training" is supportive of the hypothesis that the brain could be "trained" with the M technique. If so, it is likely this phenomenon will be seen in many other types of brain function training. Previous studies have shown significant changes associated with meditation,[24,25] prayer,[26] and glossalalia[27] (speaking in tongues), but these changes have only been tested in experienced practitioners. Since it is most probable that a true meditative state can only be achieved after months or years of training, it was not feasible to test participants trying to pray or meditate for the first time, because there would be little difference in novice practitioners. However, if our findings were replicated in other studies, it could be

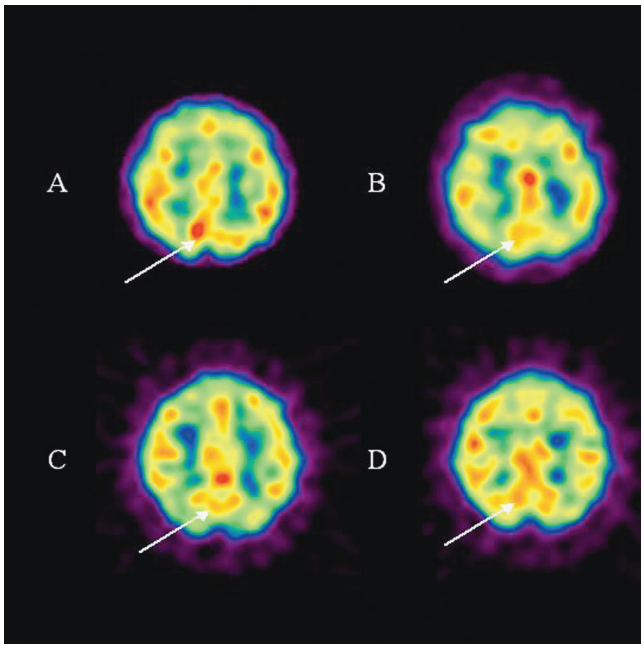

FIG. 2. Single-photon emission computed tomography of M technique and precuneus. This figure shows transaxial slices of the brain to show the precuneus. The figure compares the pre and post 1st M technique with pre and post 10th M technique. **A.** Pre 1st M. **B.** Post 1st M. **C.** Pre 10th M. **D.** Post 10th M. Cerebral blood flow is shown as red > yellow > green > blue. There is a reduction in precuneus activity of approximately 15% from baseline to post M technique (indicated by the arrows).

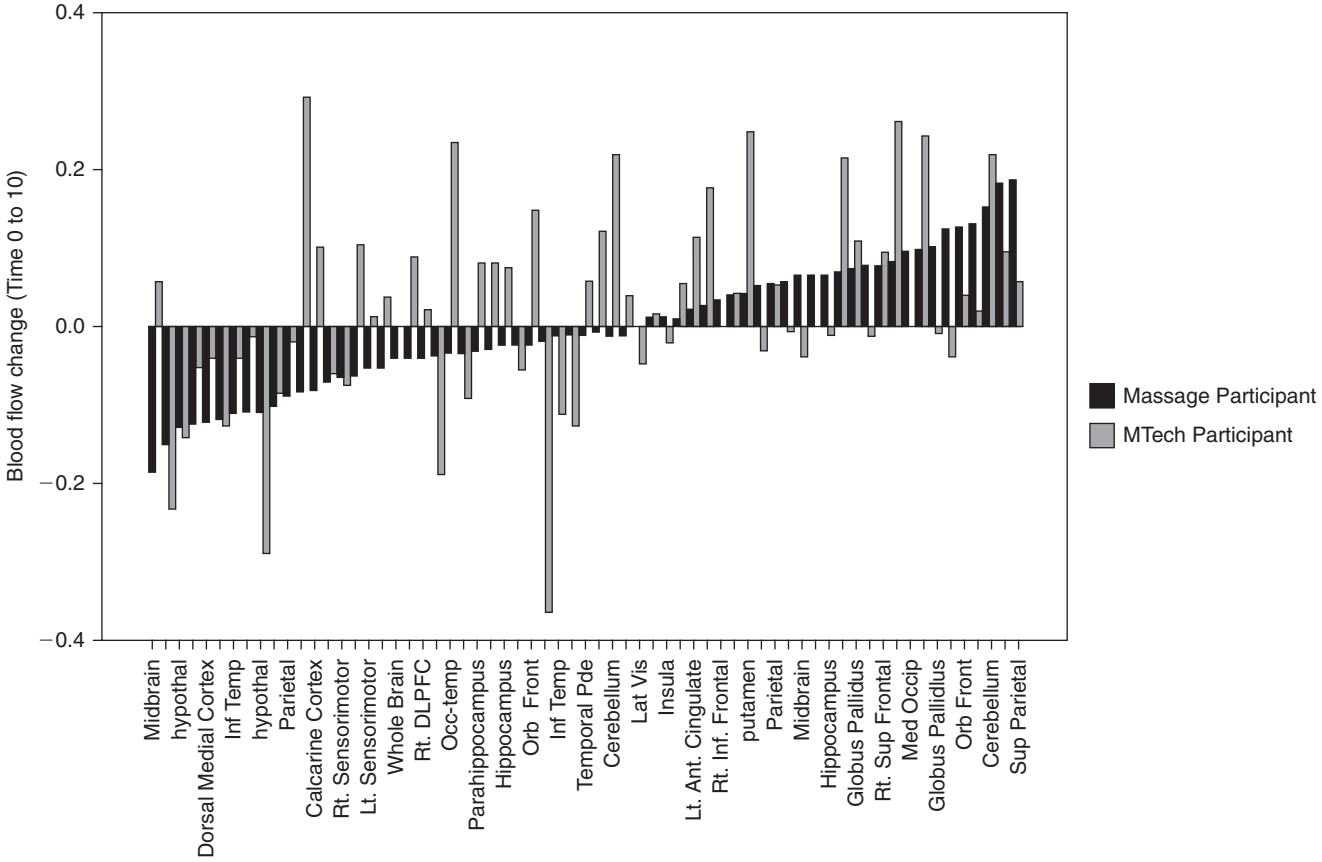

FIG. 3. Bar chart. Difference between activation changes in M and massage. The *Y* axis indicates increased (positive) or decreased (negative) activation following week 10 compared to the initial baseline. The brain regions are ordered on the *X* axis from the areas showing the greatest decrease in the massage participant to those showing the greatest increase. Not all brain regions tested are labeled. The massage participant changes are in black and the M participants are in gray. In the massage participant, changes rarely reach an increase >0.2. However, in the M participant, there is a very different pattern, suggesting that the effects of the 2 techniques on the brain are different. Hypothal, hypothalamus; inf, inferior; temp, temporal; rt, right; lt, left; DLPFC, dorsolateral prefrontal cortex; occ, occipital; orb, orbital; front, frontal; Pde, ; lat., lateral; vis., ; ant., anterior; sup., superior; med, medial.

hypothesized that our results suggest that 10 sessions of the M technique might produce some activation changes of rCBF. However, this is totally dependent on other findings replicating our own.

Several studies have shown a "reciprocal relationship between mind and body,"[27] although most studies have researched the effect of the mind on the body. Our study suggests that it might be a 2-way process; the body could be used to relax the mind, and these effects could increase when repeated over time. This concurs with previous research when sensory input was repetitively administered.[28]

Considerations for the sensory phenomenon observed in Study 2 include at least 2 possibilities. The first is that the sensory and associated brain areas have an increase in response to somatic sensory learning. There has only been 1 published study showing the effect of massage or touch on the cerebral blood flow of the brain using PET,[13] but none so far on the cumulative effects of touch over time. Despite being a small study, the areas showing changes in blood flow in our study included more than would be expected for an isolated sensory phenomenon. Clearly, this research needs to be replicated in further studies. If this were the case, perhaps the series of M treatments over 10 weeks could be perceived to induce a type of deep meditative state. This would agree with the large number of areas seen to increase in our study. It would also be in keeping with previous studies on meditation and brain analysis and would be consistent with the experience reported by the participants. The participant who received the 10 M techniques said that she felt an "accelerated relaxation response with each session," that the "hypnotic or meditative state deepened" with each session, and that she "floated in and out of consciousness." The massage participant said she "felt relaxed" but did not mention a hypnotic or meditative state or that the effect deepened over time. Again, any data from a single patient must be replicated in further studies. However, as a result of this study, there are a number of factors that should be addressed in future studies. One is to more strictly standardize the time between the end of treatment and the injection of the second radioisotope. A second would be to have objective measures of autonomic activity such as heart rate variability and low frequency/high frequency ratio. A third would be to document the right/left handedness of participants because this could affect which side of the brain was activated. In addi-

tion, a study of the longevity of the effect could also be undertaken with different periods between the treatment and the injection of radioisotope, plus an analysis of the number of sessions that are required to achieve a measurable effect. It would also be important to statistically examine the size of the effect and utilize a more comprehensive approach to obtaining subjective data about how each participant perceived the treatment process. Our participants were asked how they felt after each M technique or massage, but there were no standardized measures (physiologic or psychologic). Sagar's meta-analysis concludes that further studies are required on massage.[29] Future studies could explore how cerebral activity, as measured by EEG patterns and neuroimaging studies, covary as well as their relationship to basic physiologic measures such as blood pressure, heart rate, and respiratory rate.

Conclusions

Given the small sample size and lack of controls, caution should be used in the generalization of these findings. However, our research supports pieces of existing research (as illustrated above). We therefore conclude that the administration of the M technique and conventional (Swedish) massage appear to both lead to changes in brain function, but with some potentially key differences. There was significantly greater rCBF activation change in the M technique participant than in the massage participant in Study 2. Also, it suggests that it may be possible to train the human brain to respond to touch in a more pronounced fashion after a series of administrations when using the M technique. (There was no significant training or cumulative effect for massage at the end of 10 weeks.) Finally, while this is very preliminary, it appears that the M technique may affect different areas of the brain as compared to conventional massage, and in a much more profound way. If further studies replicated our findings, it may be that the M technique, which is based on structured repetition, induces a hypnotic/meditative state. Further studies are needed to explore and, it is hoped, replicate, these effects of touch (on the right caudate and precuneus in particular) on a larger group of participants receiving the M technique. If we are correct in our hypothesis, the cumulative effects the M technique could be particularly interesting in the clinical area of chronic pain symptomatic relief. Finally, this type of study could be applied to other forms of massage (i.e., reflexology, acupressure, shiatsu) to explore whether different kinds of touch are associated with different neurophysiologic correlates.

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Author Disclosure Statement

No competing financial interests exist.

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Appendix: The M Technique—Gentle Strokes for Fragile Folks

The M technique is a registered method of touch that is suitable for the very fragile, actively dying, or when conventional massage is inappropriate. The M stands for manual and to differentiate it from conventional massage.[1] The M technique is a series of a set number of gentle stroking movements performed in a set sequence, at a set pressure and a set speed.[2] As it is choreographed,[3] it is completely reproducible and therefore a useful research tool.[4] The M technique is so gentle and soothing that people often refer to it as "physical meditation."[5] The M is intended to enable both giver and receiver to relax very quickly. It is simple to learn, requiring only 14 hours of instruction for a full body M and 1 hour for a hand M technique. (Conventional massage requires between 600 and 1000 hours of study.) The rationale for the set form of repetition is to remove anxiety in the receiver. The first time the receiver experiences a sequence, he or she will pay attention. The second time they feel the same stroke, the receiver will recognize it. The third time the receiver knows exactly what is going to happen and begins to relax. The M technique uses a set pressure of 3 where 0 is no pressure, and 10 is crushing pressure. Several small pilot studies in clinical settings have found the technique to be effective in reducing terminal agitation[6,7] and insomnia.[8] The M technique was registered by the PI in 1998. Dr. Buckle is paid to teach a certification course to health professionals such as massage therapists/nurses wishing to learn the technique; however, she has no other financial interest in the technique, which is used worldwide and is being accepted as part of nursing care in some U.S. hospitals. For more information, please see www.Mtechnique.co.uk and www.rjbuckle.com.

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