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COMPARATIVE STUDY

Effectiveness of traditional Thai massage versus Swedish massage among patients with back pain associated with myofascial trigger points

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Summary The aim of this study was to verify the effectiveness of traditional Thai massage (TTM) among patients with back pain associated with myofascial trigger points (MTrPs). Swedish massage (SM) was selected as the treatment for the comparison group. One hundred and eighty patients were randomly allocated to receive either TTM or SM for 6 sessions during a 3–4 week period, with follow-up 1 month later. Results indicated that pain intensity, assessed using the visual analog scale (VAS), among patients in both groups was reduced by more than half after 3 weeks of treatment and for up to one month afterwards ($P<0.05$) with no significant difference in VAS between the groups. Similar improvements were found for most other outcome measures. We conclude that TTM and SM are effective in reducing back pain among patients with MTrPs. We therefore suggest that massage therapy, and in particular Thai massage, be considered as an alternative primary health care treatment for this disorder.

Background

Myofascial trigger points (MTrPs) are a common and painful musculoskeletal disorder. According to Simons et al. (1999), MTrPs are the most frequently

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diagnosed and well-documented source of back pain. Finding effective treatments for back pain from MTrPs is a challenge that is currently being given much attention by allied health professionals. The popularity of alternative medical treatment for many conditions has increased during recent years and massage has been documented as one of the most frequently used alternative treatments for back pain (Eisenberg et al., 1998).

The ultimate goals of massage therapy for MTrPs are to deactivate the trigger points, eliminate pain, restore normal tissue mobility, and improve function. The overall success of massage therapy in being able to achieve these goals is difficult to assess because of various confounding variables, including the many differences in massage technique, which use different maneuvers and varying amounts of pressure.

A summary by Rachlin (1994) indicated that, although some types of superficial massage, such as those consisting of stroking and kneading, are good for general relaxation, massaging the area of reported pain without trying to find and eradicate the trigger point will not provide the patient with lasting relief. This reported lack of long-term effect from such types of massage may be due to the application of insufficient pressure to deactivate trigger points and break down adhesions. However, it has also been found that some forms of deep massage (deep friction, compression, ischemic compression) have produced side-effects such as post-massage soreness and ecchymosis when applied to the trigger point specifically, with no accompanying treatment of the surrounding back muscles (Rachlin, 1994; Simon et al., 1999).

A combination of deep and superficial massage for more effective treatment of MTrPs was therefore suggested by Rachlin (1994). The recommended technique consists of an initial period of Swedish massage (SM)-like techniques, including stroking, kneading and stripping, to warm the tissue and make it more elastic, after which the practitioner is more able to apply increased pressure, such as friction massage, deep into the muscle with reduced discomfort for the patient.

This combination of superficial and deep massage appears to be effective in the relief of back pain from MTrPs, however it requires highly skilled practitioners and is time-consuming in terms of treatment time for the patient.

A similar, but less complex and possibly more practical, choice of treatment may be traditional Thai massage (TTM). The technique of TTM is considered as a form of deep massage, however, the pressure applied during TTM is believed to be gentler than that applied using other deep massage techniques, and therefore may not elicit the same side-effects as have been found with deep tissue massage alone. TTM is applied to the whole muscle surrounding the MTrPs, thus it is likely to result in better overall relaxation and to benefit the patient more than other forms of deep massage, which focus only on the trigger point. In addition, TTM has been shown to produce powerful analgesic effects and to be an effective means for releasing trigger points and alleviating pain (Prateepavanich, 1999).

TTM is very popular, not only in Thailand but also in other countries in the world. Unfortunately, controlled studies to support the effectiveness of TTM for the treatment of different conditions are very limited. Therefore, we decided to conduct a randomized clinical trial to assess the effectiveness of TTM in the treatment of back pain involving MTrPs, in order to contribute much-needed knowledge to this field of complementary medicine. Ideally, we wished to study the effect of TTM on back pain associated with MTrPs compared with the effect if no treatment having been received, however this was not possible for ethical reasons. Thus, it was decided to compare the effects of TTM with the effects of a comparable Western form of massage. SM, which uses techniques such as stroking and kneading, was selected as the best comparable massage form since it also applies massage techniques to the whole back, however it differs in the amount of pressure applied. In SM, pressure is applied to the superficial layer of back muscle but does not go deep enough into the muscle to reach the patient's pain threshold in the way that TTM does.

It was hoped that the results of this study could be used as a guide for the Thai Ministry of Public Health in making recommendations for the routine treatment of back pain from MTrPs.

Methods

Design and setting

This prospective, parallel group, randomized clinical trial was conducted in the Department of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University, Thailand. The ethical committee of Khon Kaen University approved the research protocol.

Participants

Potential participants, aged 21–50 years, were recruited through public announcement broadcasts

by local radio stations and through flyers posted around the city of Khon Kaen, during a 10 month period between August 2003 and May 2004. These recruitment announcements called for individuals who had experienced persistent back pain, either sub-acute (lasting for 4–12 weeks) or chronic (lasting for over 12 weeks), to volunteer to take part in the study. Subjects for inclusion in the study were primarily selected by a Physical Therapist. In cases where there was doubt about eligibility for inclusion, a confirmatory examination was conducted by a Physical Medicine and Rehabilitation doctor. Baseline data were collected from all eligible individuals who responded to the announcements.

The clinical criteria for the diagnosis of MTrPs in this study were a modification of that specified by Travell and Simon (1983). The inclusion criteria were that patients had experienced spontaneous back pain for longer than 4 weeks and that at least one trigger point was present in the upper and/or lower torso region. Trigger points were diagnosed as the presence of focal tenderness at a palpable nodule in a taut band and with pain recognition.

Even if subjects met the above criteria, individuals were not included if they had at least one of the following conditions: menstruation, pregnancy, or a temperature of more than 38.5 °C on the day of examination; a history of acute trauma, back-surgery, spinal fracture, joint subluxation or instability, inflammatory joint disease (rheumatoid arthritis or gout), muscle disease, malignancy or infection; or evidence of neurologic deficit, multiple sclerosis, hemi/paraparesis or myelopathy, skin diseases, or infectious diseases (tuberculosis or AIDS). In addition, if any individual was considered to be unable to commit to the full course of treatment and follow-up they were also excluded prior to the start of the study.

Informed consent was obtained prior to the baseline examination

Procedure

Randomization

There were 180 patients who met the above inclusion/exclusion criteria and they were randomly allocated to one of the two treatment arms using block randomized allocation with block sizes of 2, 4, and 6. Groups were assigned using a pre-generated random assignment scheme enclosed in envelopes, which resulted in a total of 90 patients per group.

Treatment

All eligible patients received one of two treatments, either TTM or SM, during six sessions over a period of 3–4 weeks. For the majority of patients, treatment occurred according to the planned schedule of two sessions a week for 3 weeks. Patients who could not complete the treatment program within 4 weeks were excluded from the trial (see Fig. 2 for details of patients who did not complete the study). Treatment was given for 30 min and followed by 10 min of passive stretching, which was similar in both groups.

Stretching exercises were included since they are an integral part of TTM. Stretching was also included after SM to maintain comparability of the groups and also for ethical reasons, since the literature suggests that stretching the muscle after treatment for MTrPs provides longer-term pain relief (Travell and Simon, 1983; Jaeger and Reeves, 1986; Hanten et al., 2000). Both forms of massage treatment were given by one of three massage therapists who had 4, 8 and 20 years, respectively, of experience in TTM. Although each patient received the same type of massage at each visit, the massage therapist was not always the same person for each patient. Each massage therapist was trained in both TTM and SM for at least 3 months prior to the study so that they all had the same standard of practice in both forms of massage. Training was given by one physical therapist who had 15 years of physical therapy experience and more than 10 years of TTM experience, with certification from the Institute of Thai Traditional Medicine, Department of Medical Services, Ministry of Public Health. At the end of the training period, each massage therapist was tested by the trainer, until the therapists were considered to be similar in terms of the differential degree of pressure applied for SM and TTM (the trainer started to feel some pain (SM) or the trainer's pain threshold was reached (TTM)) and in how they followed the expected steps for both massage techniques.

In keeping with the recommendation of Khon Kaen University's ethical committee, patients in both groups were given verbal and written information at the start of the study about a recommended home care program, which consisted of back stretching exercises and health care education (correct posture and lifting techniques).

Assessments

All outcome measures were assessed by one physical therapist with 15 years of experience, for whom the treatment groups were blinded. The reliability of outcome measures (such as the pain

intensity, the range of motion of the thoracolumbar spine in all directions, body flexibility, and the pressure pain threshold (PPT)) was tested on 30 patients with back pain associated with MTrPs prior to data collection. All outcome measures showed a very high degree of correlation (Intraclass Correlation Coefficient (ICC) over 0.95).

To evaluate the immediate therapeutic effectiveness of the massage treatments, all outcome measures were assessed immediately before and after the first treatment on day 1. To evaluate the short-term effects during the intervention period, all outcome measures were assessed before and after the second and the third week of treatment (just before the fifth treatment and a few days after the sixth treatment respectively). To evaluate the long-term effectiveness of the intervention, all patients returned for follow-up assessment one month after the last treatment.

Interventions

Traditional Thai massage

TTM in this study was performed according to the system of royal Thai massage, which applies the theory of ''10 Sens'', based on the concept of invisible energy lines (Sens) running through the body (Tapanya, 1993). Massage points included in this method are located along two lines and at an additional, single, point on each side of the back (Fig. 1). The first line of massage starts from a point 2 cm above the posterior superior iliac spine (PSIS) and ends at the thoraco-cervical junction or C7. Each point on this line is approximately one finger breadth away from the spinous process. The second line follows the same course but is about two finger breadths away from the spinous process. The single massage points on each side of the back are located three finger breadths away from the spinous process of the L2 vertebra. The pressing technique employed in TTM uses the body weight of the massage therapist to apply gentle, gradually increasing, pressure through the therapist's thumb finger, palm and elbow. Pressure is applied until the patient starts to feel some pain (pain threshold) (Prateepavanich et al., 1999) after which the pressure is maintained for 5–10 s at a time. This sequence can be repeated several times for each massage point.

Swedish massage

The SM treatment was performed using body-oil (jojoba oil) for lubrication of the skin. Pressure was applied on the area of the back between PSIS and C7. This pressure was enough to reach deep into the skin and subcutaneous tissue, but was not sufficient to reach the pain threshold of each patient. SM techniques used in this study included light stroking or effleurage, and petrissage (which consist of kneading with the thumb, digit, and palm; wringing and skin rolling).

Outcome measures

Each patient's demographic characteristics and medical history were recorded. Clinical outcomes were grouped as patient-rated outcome measures and as back performance measures. All outcomes were measured as described below

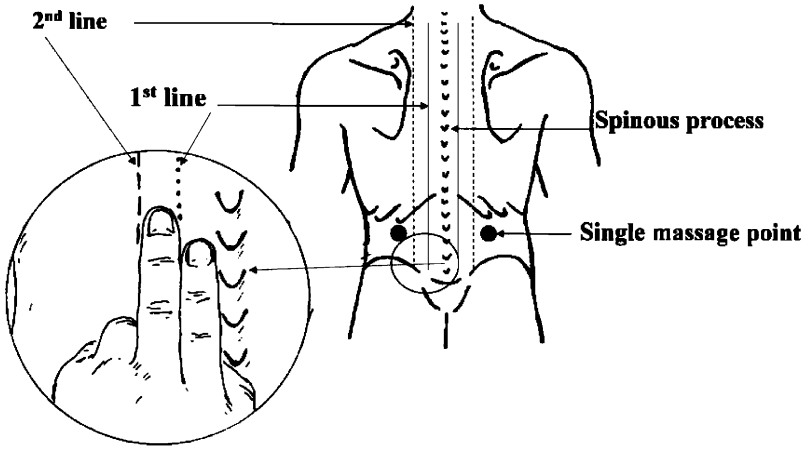

Figure 1 The massage points: running from thoraco-cervical junction or C7 to posterior superior iliac spine (PSIS) (each point in the first line is one finger's breadth from the spinous process [1], in the second line it is two finger breadths from the spinous process [2] and the two massage points (dark dots) are located at the level of L2, three finger breadths from the spinous process).

Patient-rated outcome measures

Pain intensity by visual analog scale: (*the primary outcome measure*): Before receiving each treatment, patients were asked to rate the average intensity of their back pain over the past 24 h on a 10-cm line, which was used as a scale of relative pain intensity. After each treatment the patient was asked to use the same scale to rate their pain at that moment. Reliability and construct validity of data obtained with the VAS have been previously assessed and reported to be high ($r = 0.99$ for reliability) (Carlsson, 1983; Wilkie et al., 1990).

Disability by Oswestry disability questionnaire (*ODQ*): The ODQ (with an outcome score of 0–100) was used to assess the disability of each patient. The ODQ contains 10 questions about pain intensity and its effect on sleep, self-care, walking, sitting, standing, lifting, sex life and traveling. In this study, the Thai version of the questionnaire, designed to assess disability of patients with nonspecific low back pain was used. This version has been proved to have high reliability, with the Cronbach's alpha coefficient for every question of the questionnaire exceeding 0.7 and all inter-item correlations exceeding 0.4) (Sae-jung et al., 2002).

Patient satisfaction with their treatment: Satisfaction of patients with their own treatment was assessed using a 4-point scale, ranging from 1 (completely dissatisfied) to 4 (very satisfied).

Side-effects and medication used: Questions were asked about any symptoms of side-effects and about any medications used during the 3 weeks of treatment and answers were recorded as ''yes'' or ''no''.

Back performance

Thoracolumbar spine range of motion (*ROM*): The modified Schober test for ROM was used to assess the mobility of the Thoracolumbar spine in the directions of flexion, extension, and left and right lateral flexion (Reese and Bandy, 2002). The distance moved in each direction was measured using a tape measure. The reliability of lumbar flexion and extension for assessment among patients with low back pain has been reported to be $r = 0.78-0.89$ for lumbar flexion and $r = 0.69-0.91$ for lumbar extension (Irnich et al., 2001; Gunn, 1996).

Body flexibility

A sit-and-reach box was used to measure body flexibility three times. The average of the three measurements was recorded in centimeters. The reliability of this test for patients suffering from back pain has not yet been reported.

Pressure pain threshold

The PPT for each patient was measured using a pressure algometer or Dolorimeter (0–11 kg/cm^2, distributed by Pain Diagnostics and Treatment Inc., Great Neck, New York) on the most painful trigger point. Measuring PPT in this way has been reported as a reliable method for assessing the severity of MTrPs, with reliability measures in the range of $r = 0.68-0.86$ (Reeves et al., 1986).

Additional secondary outcome measures were: the patient's expectations of their own treatment using a 4-point score: 1 (worse), 2 (no change), 3 (better), or 4 (much better); and the presence of any psychological problems, which were assessed using a stress test (self-assessment) developed by the Department of Mental Health, Ministry of Public Health, Thailand (Phattharayuttawat, 2002). This test is short and simple, with a reported Cronbach's alpha coefficient of 0.84. The test consists of 20 questions, each of which is answered using a rating scale of 0–3. Examples of these questions are: whether the individual suffers from sleep deprivation due to worries, whether they feel unhappy, depressed, or suffer from dizziness, etc.

Statistical analyses

Estimation of the sample size

Estimation of the sample size was based on a pilot study (total $n = 30$) that compared the effectiveness of TTM with that of SM for subjects with back pain associated with MTrPs. Based on this pilot study, a drop-out rate of 15% was allowed for in estimating the final sample size and a standard deviation (of VAS) of 2.2 was used to calculate the sample size needed to detect a 1-point change of pain (which was considered as the lowest level to accept clinical significance of the results) with 80% power and 5% significance. According to these criteria 180 patients were recruited.

Data analyses

Outcome measures were analyzed as continuous variables and presented as the mean and standard deviation (SD). This study aimed to analyze each outcome separately at different points of time over the period of treatment to provide data on the immediate, short, and long-term therapeutic effectiveness of the massage therapy. All analyses were performed on the basis of intention-to-treat.

Paired *t*-tests were used to compare outcome variables at baseline (measures taken immediately before the first treatment) with outcome measures at both 3 weeks and at 1 month after the last treatment. Since the randomization method did not

guarantee that baseline characteristics would be the same between groups, analyses of covariance (ANCOVA) were performed. Outcome variable measures taken immediately before the first treatment were entered as covariates. This analysis was used to compare differences in outcome measures between the two treatment groups and to estimate the adjusted mean differences and the 95% confidence intervals for each outcome measure at each evaluation time point. Analyses were performed using STATA Version 7 (StataCorp LP, 4905 Lakeway Drive College Station, Texas 77845, USA).

Results

Randomization and progress through the trial

Two hundred and fourteen potential subjects responded to the recruitment advertisements and were screened for eligibility for the study. Of these subjects, 180 met the inclusion/exclusion criteria and signed the consent forms to take part in the study. Ninety subjects were randomly selected to receive TTM and the other 90 subjects received SM. Five subjects from the TTM group and three from the SM group dropped out during the period of the study. A detailed summary of patient recruitment, participation, attrition and reasons for dropping out from the study is shown in Fig. 2.

Demographic and baseline clinical characteristic

Details of demographic and clinical characteristics are shown in Table 1. The average age of patients who participated in the study was 36 ± 9 years. Most patients (63%) were women. Ninety-five percent of the patients performed jobs involving only light physical work. Patients in the TTM group initially reported slightly more intense pain (VAS) than those in the SM group (5.5 ± 1.5 and 5.2 ± 1.7, respectively), however, the difference in between the groups was small (0.3). Almost all baseline characteristics were fairly equally balanced between the two groups. The only characteristic that showed a noticeable difference between the two groups was the patient's physical work load (see Table 1).

Main outcome measure

Fig. 3 shows that after 3 weeks of treatment, the pain intensity (VAS) of patients in both groups declined to less than 50% of their baseline values. The mean VAS at baseline for patients in the TTM group was 5.5, which was reduced to 2.2 (difference 3.3, 95% confidence interval 2.8–3.7, $P<0.05$) after 3 weeks of treatment. For patients in the SM group, the mean VAS at baseline was 5.2, which reduced to 2.0 (difference 3.2, 95% confidence interval 2.8 to 3.7, $P<0.05$) after 3 weeks of treatment. This reduction in VAS was maintained up to 1 month later in both treatment groups (Fig. 3 and Table 2).

After the first day of treatment a slightly greater improvement in the VAS was indicated for the SM group when compared with the TTM group. However the difference in VAS between the two groups was only 0.4 (95% confidence interval 0.0 to −0.9, $P = 0.05$) (Table 3), and therefore not clinically relevant. Comparison of the relative effects of the two different treatments showed no significant difference in the degree of reduction in VAS between the groups at the end of 3 weeks of treatment (difference between groups 0.2, 95% confidence interval −0.4 to 0.7, $P>0.05$), or at evaluation 1 month later (difference between groups −0.2, 95% confidence interval −0.8 to 0.4, $P>0.05$) (Table 3).

Therefore, overall results indicate that the VAS improved at approximately the same rate, and with the same magnitude, within each of the two groups (see Fig. 3 and Table 3 for details of this).

Secondary outcome measure

Table 2 shows that patients in both massage groups reported improvements in almost all secondary outcome measures at all post-treatment assessment times, similar to results for the primary outcome measure.

Comparison of the improvements between the two treatment groups is shown in Table 3. The only secondary outcome indicator that showed a statistically significant difference in the degree of improvement between the two treatment groups was the PPT. At evaluation one month after the end of treatment the PPT was found to be significantly higher (improved outcome) in the TTM group than the SM group (difference between groups 0.4 kg/cm^2, 95% confidence interval 0.2 to 0.7 kg/cm^2, $P<0.05$).

In terms of patient satisfaction, all patients from both groups reported that they were "very satisfied" with their assigned treatment.

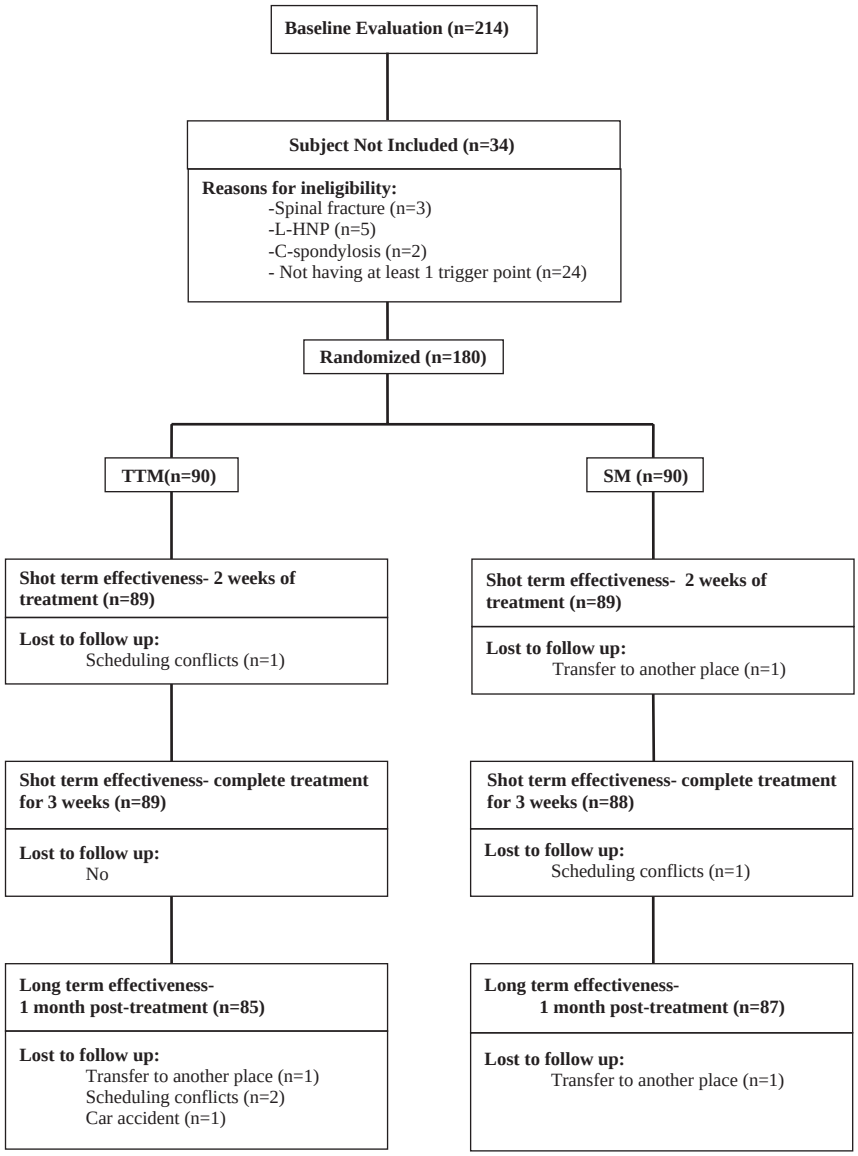

Figure 2 Participant numbers throughout the study and reasons for dropping outs.

Side-effects and medication used

During the treatment period between 5 and 10 patients from each group reported having a little soreness after each treatment (Table 2), however, these side-effects disappeared after 5–10 min. In addition, 5 patients from the SM group reported an allergic reaction (rashes and pimples) to the massage oil, 4 of them reported this effect after the last treatment, but 1 of them reported this side effect after receiving the treatment on day 3, and this patient was reassigned to the TTM group, according to intention-to-treat methodology. There was, however, no difference in the overall results when this patient was excluded from one or both groups for analysis. None of the patients reported using analgesic medication for their back symptoms during the time of this study.

Discussion

The findings of this study suggest that pain intensity (VAS) among back pain patients with MTrPs can be reduced by over 50% after only 3 weeks of treatment with either TTM or SM. These results demonstrate the effectiveness of both TTM and SM massage when followed by passive stretching.

Previous studies using a similar combination of massage and stretching found comparable results. For example, Hanten et al. (2000) reported a 50%

Table 1 Demographic and baseline clinical characteristic.

Characteristics	TTM	SM	Total
Number of patients	90	90	180
Demographic			
Age(years)	37.3 (8.8)	35.5 (8.8)	36.4 (8.8)
Gender (*n* (%) female)	57 (63)	57 (63)	114 (63)
Weight (kg)	57.6 (9.9)	58.5 (11.7)	58.1 (10.8)
Height (cm)	158.5 (16.6)	160.0 (13.3)	159.2 (15.0)
Exercise; *n* (%)			
1–3 times a week	46 (51.1)	50 (55.6)	96 (53.3)
$> = 3$ times a week	4 (4.5)	5 (5.5)	9 (5.0)
Occupation by physical work load; *n* (%)			
Heavy work	7 (7.8)	2 (2.2)	9 (5)
Lighter work	83 (92.2)	88 (97.8)	171 (95)
Causes of back pain; *n* (%)			
None or cannot remember	10 (11.1)	6 (6.7)	16 (8.9)
Carrying heavy objects	20 (22.2)	23 (25.6)	43 (23.9)
Prolonged sitting during work	32 (35.6)	40 (44.4)	72 (40.0)
Accident	2 (2.2)	1 (1.1)	3 (1.7)
Lack of exercise	6 (6.7)	6 (6.7)	12 (6.7)
Carrying heavy objects and prolonged sitting with others activities	12 (13.3)	9 (9.9)	21 (11.7)
Others causes	8 (8.9)	5 (5.6)	13 (7.2)
Duration of back pain episode (month)	36.6 (38.8)	34.8 (35.6)	35.7 (37.1)
Duration of the last episode of back pain (weeks)	6.7 (8.1)	5.2 (5)	5.9 (6.7)
Stress level; *n* (%)			
Lower than normal	9 (10)	10 (11.1)	19 (10.6)
Normal	55 (61.1)	58 (64.4)	113 (62.8)
Higher than normal	26 (28.9)	22 (24.4)	48 (26.7)
Expectation of their own treatment; *n* (%)			
To feel better or much better	90 (100)	89 (98.9)	179 (99.4)
Patient-rated outcome measure			
Pain intensity (VAS 0–10 cm)	5.5 (1.5)	5.2 (1.7)	5.4 (1.6)
Disability (Oswestry disability questionnaire 0–100 scale)	20.70 (8.9)	20.73 (8.4)	20.7 (8.6)
Patient's satisfaction with treatment			
n (%) (total $n = 86$/group)			
Satisfied	13 (15.1)	11 (12.8)	24 (14)
Very satisfied	71 (82.6)	74 (86.1)	145 (84.3)
Back performance			
Thoracolumbar spine flexion (cm)	8.3 (1.7)	8.4 (1.6)	8.3 (1.6)
Thoracolumbar spine extension (cm)	5.2 (1.8)	5.0 (5.5)	5.1 (4.1)
Thoracolumbar spine left lateral flexion (cm)	19.8 (3.4)	19.0 (4.8)	19.4 (4.2)
Thoracolumbar spine right lateral flexion (cm)	18.9 (3.9)	18.2 (4.1)	18.5 (4.0)
Body flexibility (cm)	1.4 (13.2)	1.5 (9.9)	1.5 (11.7)
Pressure pain threshold (kg/cm^2)	2.7 (0.9)	2.6 (1.0)	2.7 (1.0)

Note: All continuous characteristics are reported in mean (SD), etc. age, weight, height, etc.
All category characteristics are reported as number (percentage), gender, exercise, stress, etc.

reduction in pain intensity using a combination of ischemic pressure followed by sustained stretching to treat neck and upper back pain. Similarly, Preyde (2000) reported a reduction in present pain index after 4 weeks of comprehensive massage (soft tissue manipulation, consisting of deep friction, trigger point and neuromuscular therapy, combined with stretching exercises) to treat low back pain. However, these previous studies did not examine the effectiveness of TTM specifically and they also differed from our study in terms of the underlying condition, the body area treated, the duration of treatment and the form of massage used.

In terms of the comparison between TTM and SM, our study found no clinically significant differences between the two treatment groups for either the primary or secondary outcome measures. During the initial treatment period, there was a trend

Table 2 Patient-rated outcome measures and back performance outcome measures at all assessment time points during the 3 weeks of intervention and at 1 month post-final treatment.

Outcome	Group	Baseline	Day 1	Week 3	Month 1
Patient-rated outcome measure					
Pain intensity (VAS), mean (SD)					
	TTM	5.5 (1.5)	4.1 (1.9)*	2.2 (1.9)*	2.4 (1.9)*
	SM	5.2 (1.7)	3.4 (1.9)*	2.0 (1.7)*	2.5 (2.0)*
Patient satisfaction	TTM	NA	83	88	NA
Very satisfied (%)	SM		86	82	
Having side effects, *n* (%)	TTM	NA	9	12	NA
(soreness after treatment)	SM		10	10	
Disability (ODQ), 0–100 scale; mean (SD)	TTM	20.7 (8.9)	NA	13.8 (8.8)*	13.4 (10.1)*
	SM	20.7 (8.3)	NA	15.4 (9.1)*	13.9 (8.9)*
Back performance: mean (SD)					
Thoracolumbar spine flexion (cm)	TTM	8.3 (1.7)	8.5 (1.6)	8.5 (1.8)	NA
	SM	8.4 (1.6)	8.4 (1.6)	9.3 (8.6)	
Thoracolumbar spine extension (cm)	TTM	5.2 (1.8)	5.3 (1.9)	5.6 (2.0)*	NA
	SM	5.0 (5.5)	5.1 (4.4)	5.1 (2.8)	
Thoracolumbar spine left lateral flexion (cm)	TTM	19.8 (3.4)	19.9 (3.5)	20.0 (3.6)	NA
	SM	19.2 (4.4)	19.4 (4.2)	19.3 (3.8)	
Thoracolumbar spine right lateral flexion (cm)	TTM	18.9 (3.9)	19.5 (3.8)*	19.6 (4.0)*	NA
	SM	18.2 (4.1)	19.0 (3.7)*	19.4 (3.9)*	
Body flexibility (cm)	TTM	1.4 (10.5)	2.5 (9.8)*	3.6 (9.6)*	NA
	SM	1.3 (9.8)	2.4 (9.0)*	3.7 (1.9)*	
Pressure pain threshold (kg/cm^2)	TTM	2.7 (0.9)	3.0 (1.3)*	3.5 (1.4)*	4.2 (1.3)*
	SM	2.6 (1.0)	2.8 (1.2)*	3.4 (1.5)*	3.6 (1.5)*

Note: TTM is traditional Thai massage and SM is Swedish massage. ODQ = Oswestry Disability Questionnaire, NA = not available.

*Significant improvement (decrease in VAS and ODQ, increase in back performance) from baseline levels ($P<0.05$).

towards increased pain reduction with SM when compared with TTM, however, both the overall difference between the two groups and the upper limit of the 95% confidence interval of this difference were less than 1 on the VAS, which is generally considered as the minimum value when looking for a significant clinical difference between groups. Looking at the longer term effect, there was a statistically significant difference in the degree of improvement in the PPT between treatment groups, with patients in the TTM group showing a greater increase in PPT than patients in the SM group. However, again both the difference between groups and the upper limit of the 95% confidence interval were too small to conclude that the difference was clinically significant. We can therefore conclude that both treatment types had equal therapeutic effectiveness in the treatment of patients with back pain associated with MTrPs.

The similarity between the results from the different treatment groups may be due to the following reasons: Firstly, in order to make the two treatments as comparable as possible, the massage therapists from both groups were not informed about the location of the trigger points (since in SM, and in the standard form of TTM, therapists do not generally focus on the trigger points). However, based on the theory that a combination of superficial and deep massage, similar to that of TTM, is the most effective treatment for MTrPs Rachlin (1994) and on the fact that MTrPs usually lie in the same area of the back covered by the lines of TTM, it was still expected that the deeper pressure used in TTM would have been more effective than SM in breaking down the trigger points, resulting in a greater and more sustained reduction in VAS. The fact that SM achieved the same long-term reduction in pain intensity as TTM somewhat contradicts both the expectations of this study and the recommendations of Rachlin. Secondly, even when SM is correctly applied, with lighter pressure than used for TTM techniques, the deep stroking and kneading techniques of SM may be able to break down trigger points and muscle adhesions and result in overall relaxation and reduced pain, in a manner comparable to that of TTM. Finally, the

Table 3 Comparison of the adjusted mean and 95% CI of outcome measures (adjusted for baseline using ANCOVA) at each assessment time point.

Outcome	Immediate effectiveness (day 1)				Short-term effectiveness (after 3 weeks of treatment)				Long-term effectiveness (1 month follow-up)			
	TTM	SM	Difference (95% CI)	*P*-value	TTM	SM	Difference (95% CI)	*P*-value	TTM	SM	Difference (95% CI)	*P*-value
Patient-rated outcome measure												
Pain intensity (VAS)	4.0	3.6	0.4 (0.0 to 0.9)	0.05	2.2	2.0	0.2 (−0.4 to 0.7)	0.56	2.4	2.6	−0.2 (−0.8 to 0.4)	0.51
Disability (ODQ)					13.7	15.3	−1.6 (−3.9 to 0.6)	0.16	13.4	14.0	−0.6 (−2.4 to 1.1)	0.47
Back performance												
Thoracolumbar spine flexion (cm)	8.6	8.4	0.2 (−0.1 to 0.5)	0.20	8.5	9.2	−0.7 (−2.5 to 1.1)	0.46			NA	
Thoracolumbar spine extension (cm)	5.2	5.1	0.1 (−0.9 to 1.1)	0.81	5.6	5.1	0.5 (−0.2 to 1.2)	0.14			NA	
Thoracolumbar spine left lateral flexion (cm)	19.7	19.6	0.1 (−0.6 to 0.9)	0.80	19.9	19.5	0.4 (−0.5 to 1.3)	0.38			NA	
Thoracolumbar spine right lateral flexion (cm)	19.28	19.25	0.02 (−0.6 to 0.7)	0.95	19.4	19.6	−0.2 (−1.1 to 0.7)	0.71			NA	
Body flexibility (cm)	2.43	2.46	−0.03 (−0.8 to 0.7)	0.94	3.5	3.8	−0.3 (−1.5 to 1.0)	0.68			NA	
Pressure pain threshold (kg/cm^2)	3.0	2.9	0.1 (−0.1 to 0.3)	0.39	3.5	3.4	0.1 (−0.3 to 0.4)	0.68	4.1	3.7	0.4 (0.2 to 0.7)	0.00

Note: TTM is traditional Thai massage and SM is Swedish massage. ODQ = Oswestry Disability Questionnaire, NA = not available.

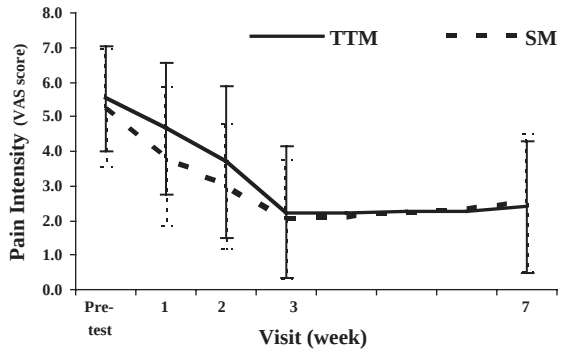

Figure 3 Pain intensity (VAS): Visit (week). (*Note*: Both groups resulted in significant improvement when compared with the baseline ($P<0.05$); average VAS at baseline and at the end of the study was about 5.3 and 2.3, respectively).

inclusion of stretching after massage as a co-intervention for both groups may have contributed to both the overall reduction in pain and to the similar sustained improvement between groups. A future study might therefore compare stretching alone to TTM and SM if this was ethically acceptable. It would also be interesting to conduct a future study with a no-treatment group comparison for the TTM group, since it is not clear from our study how many patients' back pain might have been resolved without treatment during the course of the study. However, as stated earlier, ethical considerations mean that it would not be possible for us to conduct such a study.

The similarity between the effects of SM and TTM treatments found in this study is different from the finding of the study by Franke et al. (2000). This previous study found that for patients with non-specific low back pain, acupuncture massage (in combination with individual or group exercise) was more beneficial in reducing pain than SM (in combination with individual or group exercise). The mean difference in VAS was 0.8 (95% confidence interval from 0.2 to 1.5, $P<0.05$). However, the overall difference between groups and the lower limit of the 95% CI range were both less than 1, i.e. not considered by us to be clinically significant. It was difficult to compare our study with most other studies that have been done due to variations in the forms of massage and co-interventions used, and in the symptoms being treated.

We consider the results of our study to be compelling, since the study was conducted as a randomized control trial with independent (unbiased) group allocation and intention-to-treat methodology. There was a high compliance rate, an adequate sample size and high rates of follow-up. In addition, the intra-reliability of all outcome measures was tested and found to have a very high degree of correlation. Unfortunately, this study lacked a secondary rater so it was not possible to examine the inter-observer reliability of the outcome measures, which must be considered as a weakness in the study design. Moreover, it was not feasible for the patients to be blinded to their treatment group due to the nature of the intervention.

According to the above methodology, we feel that the results of this study are valid and can be used to propose that TTM may be recommended as being equally effective as SM for treatment of back pain associated with MTrPs.

Conclusion

Based on the results of this study, we conclude that TTM or SM treatment can be used, with equal expected effectiveness, in the treatment of back pain associated with myofascial trigger points. We therefore recommend that TTM and SM be more widely promoted as alternative primary health care treatments for this disorder.

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