J. Phys. Ther. Sci.
27: 3493–3497, 2015

Original Article

Effects of traditional Thai self-massage using a Wilai massage stick^{TM} versus ibuprofen in patients with upper back pain associated with myofascial trigger points: a randomized controlled trial

Phanida Wamontree[1, 4], Naowarat Kanchanakhan, PhD[1)*], Wichai Eungpinichpong, PT, PhD[2)], Apichon Jeensawek, MD[3)]

[1)] *College of Public Health Sciences, Chulalongkorn University: Bangkok 10330, Thailand*
[2)] *Research Center in Back, Neck, and Other Joint Pain, and Human Performance, Khon Kaen University, Thailand*
[3)] *Lat Lum Kaew Hospital, Thailand*
[4)] *School of Health Science, Mae Fah Luang University, Thailand*

Abstract. [Purpose] The aim of this study was to examine the effects of traditional Thai self-massage using a Wilai massage stick^{TM} versus ibuprofen on reducing upper back pain associated with myofascial trigger points. [Subjects and Methods] Sixty patients who were diagnosed as having upper back pain associated with myofascial trigger points were randomly allocated to either a massage group using a Wilai massage stick^{TM} or a medication group taking ibuprofen for 5 days. Both groups were advised to perform the same daily stretching exercise program. Pain intensity, pressure pain threshold, tissue hardness, and cervical range of motion were assessed at baseline, immediately after the first treatment session, and on the fifth day after the last treatment session. [Results] The massage group had significant improvement in all parameters at all assessment time points. Similar changes were observed in the medication group except for the pressure pain threshold and tissue hardness. The adjusted post-test mean values for each assessment time point were significantly better in the massage group than in the medication group. [Conclusion] Tradition Thai self-massage using a Wilai massage stick^{TM} provides better results than taking ibuprofen for patients who have upper back pain associated with myofascial trigger points. It could be an alternative treatment for this patient population.

Key words: Massage, Massage stick, Trigger points

(This article was submitted Jul. 8, 2015, and was accepted Aug. 19, 2015)

INTRODUCTION

Myofascial trigger points (MTrPs) are involved in pain associated with autonomic nervous systems caused by one or several hyperirritable spots called trigger points (TrPs) in muscle tissues or fascia, leading to muscle stiffness and hence loss or failure of bodily systems[1)] and neuromuscular dysfunction[2)]. Treatment of MTrPs is aimed at relieving or eliminating TrPs and include pharmacological approaches, such as the administration of nonsteroidal anti-inflammatory drugs (NSAIDs) in conjunction with muscle relaxants or painkillers, and non-pharmacological approaches, such as ischemic compression and massage[3)]. Among the non-pharmacological approaches, massage is considered an effective treatment for MTrPs[4)]. In Thailand, traditional Thai massage (TTM) is practiced nationwide for alleviating musculoskeletal pain. The main technique of TTM focuses on pressing the points along the massage meridian lines using the thumbs or palms (which provide deeper pressure) followed by stretching the affected muscles and joints. A study regarding the effectiveness of Thai exercise with traditional massage for pain, walking ability, and QOL of older people with knee osteoarthritis also indicated that Thai massage with exercise results in pain alleviation[5)]. Although massage is an effective treatment, it usually requires a therapist or another individual, since patients may not be able to reach certain body parts, such as the upper back, by themselves. Thus, self-massage using appropriate equipment should be a viable option. One research applied a device called a Thera Cane to provide ischemic pressure followed by sustained stretching in the treatment of MTrPs and found that the treatment was effective in reducing TrP sensitivity and pain intensity[6)]. In another study, a piece of equipment called the Backnobber II was examined for its effectiveness in the relief of discomfort associated with MTrPs. The results indicated that the device was effective in bringing down muscle and fascia pain and irritability[7)]. These two types of self-massage stick, are however, a bit heavy and, relatively rigid (non-elastic

*Corresponding author. Naowarat Kanchanakhan (E-mail: naowarat.k@chula.ac.th)

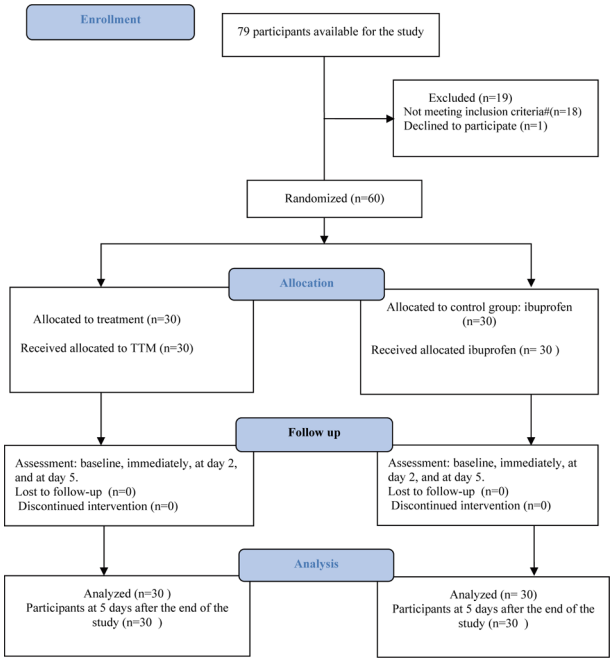

Fig. 1. Flow chart of entry and discontinuation by participants during the study

property) when performing the self-massage. The Wilai massage stick^{TM} is a lightweight device especially invented for self-massage and is made from an aluminum shaft with a 1-inch diameter bent into a shape resembling a hook. The curve of the stick was designed according to ergonomics principles to enhance gripping and handling while performing self-massage. The tip of the stick is slightly raised and has a wooden massage ball that is 1.2 inches in diameter. A preliminary study suggested that it could decrease pain and increase active range of motion (AROM) in patients with upper back pain[8]. An experimental study with a control group and appropriate sample size has not been conducted to verify these effects. Therefore, the objective of the present study was to evaluate the effectiveness of traditional Thai massage using a Wilai massage stick^{TM} in comparison with the administration of ibuprofen in reducing pain intensity and tissue hardness and in increasing the pressure pain threshold (PPT) and cervical range of motion (CROM) in patients with upper back pain associated with MTrPs.

SUBJECTS AND METHODS

The study was a randomized controlled trial approved by the Ethics Review Committee for Research Involving Human Research Subjects of the Health Science Group of Chulalongkorn University (COA No. 082/2557). It was conducted at the Traditional Thai Medicine Clinic of Lat Lum Kaew Hospital, Thailand (Fig. 1). The participants received information on the research through poster and radio announcement during June 2014 and November 2014. They gave informed consent for participation in the study. The patients included in the study were 18- to 60-year-old males and females diagnosed with upper back and having least 1 TrP for at least 12 weeks. In accordance with the

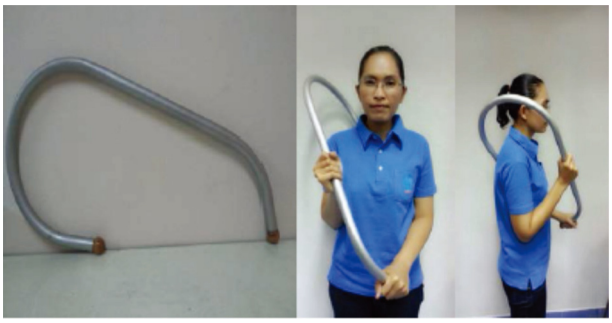

Fig. 2. Holding a Wilai massage stick^{TM}

method of following Travell and Simon[1], the diagnosis involved the presence of 1) a palpable taut band, 2) palpable nodule, and 3) palpable spot tenderness. At the time of the research, they had stopped using painkillers, NSAIDs, and/or other forms of treatment for at least 2 days. Patients were excluded from the study based on any history of disease or disorder that may be contraindicated for TTM such as contagious skin disease, injury or inflammation of muscle, bone fracture and/or joint dislocation, open wounds, and cervical radiculopathy, as were pregnant or breastfeeding women. Patients who expressed unwillingness to continue their participation in the research; suffered from severe side effects of the administration of ibuprofen or massage with the Wilai massage stick^{TM}, such as gastrointestinal bleeding or greater pain intensity; received other types of treatment other than those prescribed by the doctor during their participation, such as acupuncture and medical injection; and failed to follow the conditions of the research or missed appointments were also excluded. Sixty subjects passing the inclusion criteria were randomly allocated to treatment with self-massage using a Wilai massage stick^{TM} (TTMW) or treatment with ibuprofen (control), which was accomplished using a simple random sampling approach. There were 30 subjects in each group. The subjects were examined by a licensed physiotherapist who was not informed of their group before the beginning of the treatment, at day 1, at day 2, and at day 5 after the last treatment. In the Wilai massage stick^{TM} group (TTMW group), the patients were provided instructions regarding self-massage according to TTM principles as follows (Fig. 2). The upper back was to be divided into the left side and the right side using the spinal processes as the point of reference (Fig. 3). For each side, there were two massage lines. The first one was about the width of a finger from the spinous processes, and the second line was about the width of three fingers from the spinous processes. Each line was further comprised of eight points on the upper back region. The self-massage was performed in a sitting or standing posture, starting from the first point along the massage line on the left side of the back. The pressure was gradually increased until mild pain was felt, maintained for 5 seconds, and then released. This was performed for all the eight points and then repeated 5 times. The procedures were performed for all the massage lines of both sides of the back, lasting approximately 10 minutes and follow stretching exercise 2 minutes. Thus, the total duration of each treatment was 12 minutes, and the treatment was continued for 5 days.

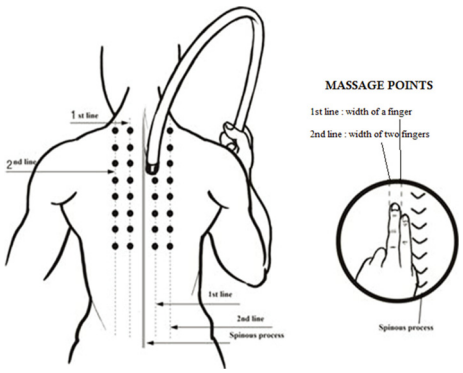

Fig. 3. The meridian massage lines of TTM on the upper back[9)]

In the medication group, the patient took 400 mg ibuprofen three times a day after each meal and performed muscle stretching 2 minutes every day for 5 days. The medication was prescribed by a licensed medical doctor. The primary outcome was pain intensity rated with a visual analog scale (VAS). The secondary outcomes included the PPT, tissue hardness, and CROM. These secondary outcome measures were measured by a physical therapist that was blinded with respect to the group allocation of the patients. The pain intensity was measured with a VAS. The patients were asked to rate the intensity of pain at the time of measurement and then marked an "X" on a 10-cm-long straight line that had the numbers 0 (indicating on pain at all) to 10 (indicating the most severe pain) marked on it from left to right. The PPT was measured using a tissue hardness meter/algometer (OE-220,ITO Co.,Ltd., Tokyo, Japan) with a pressure tip having a 1 cm diameter. Pressure was exerted vertically at a constant speed (1 kg/sec) on a TrP of the upper back and was gradually increased until the patients felt pain and pushed a button on to the algometer. Then the applied pressure was recorded. This process was done 3 times, and the reading were averaged for statistical analysis. Measurement of tissue hardness was performed using the tissue hardness meter/ algometer (OE-220, ITO Co.,Ltd., Tokyo, Japan) equipped with a 10-cm diameter plastic disc and the measuring tool was adjusted to the tissue hardness measuring mode. The device has a preset pressure sensor, and the displacement of the 1-cm pressure tip with respect to the disc indicates the tissue hardness. Pressure was gradually and vertically exerted from the handle of the tool onto the painful pressure point to be examined until a beep sounded from the tool, and the tissue hardness was then automatically recorded. This was carried out 3 times, and the readings were averaged for statistical analysis. The CROM of the patients was measured with a CROM goniometer, and the measurements included flexion, extension, left lateral flexion, and right lateral flexion. Each motion was measured 3 times, and the readings were averaged for statistical analysis. A reliability study was performed for each outcome measure before the study using 10 upper back pain patients to measure the pain intensity (VAS, intraclass correlation coefficient [ICC] =0.97), PPT (ICC=0.92), tissue hardness, and CROM (ICC=0.97). All outcomes measures showed a high degree of correlation with an ICC over 0.90. All statistical analyses were carried out with SPSS version 20. Descriptive statistics, including the mean, percentage, and standard error (SE) were used to describe continuous and concrete variables. The within-group inferential statistic used was repeated measure analysis of variance (ANOVA), whereas the between-group inferential statistic employed was analysis of covariance (ANCOVA). In order to account for baseline differences, the pretreatment results were employed as covariates. The degree of confidence was established at 0.05. Post hoc testing using Fisher's Least Significant Difference (LSD) test was applied for multiple comparisons.

Table 1. Demographic and baseline clinical characteristics of patients

Characteristics	TTMW	Control
Number of patients	30	30
Demographic data		
Age (years), mean ± SD	42.8 ± 10.0	41.6 ± 11.7
Gender, number of females	18	22
Weight (kg), mean ± SD	59.7 ± 14.7	62.4 ± 11.3
Height (cm), mean ± SD	159.7 ± 7.9	159.3 ± 7.4
Occupation by work load		
Heavy work	5	6
Lighter work	25	24
Onset of symptoms		
Acute 1–3 days	2	4
Subacute < 3 months	3	2
Chronic > months	25	24

RESULTS

The average ages of the patients participating in the study were 42.8±10.0 and 41.6±11.7 in the TTMW and control groups, respectively. The majority of the patients were females (73%) doing jobs that were not physically demanding (83%). Moreover, when the two groups were compared in other aspects, they were found to have very similar characteristics (Table 1). As show in the Table 2, the results indicated improvement with TTMW in terms of pain intensity, PPT, tissue hardness, and CROM immediately after the first treatment session, 1 day after the last treatment session, and 5 days after the last treatment session ($p<0.05$). In contrast, administration of ibuprofen led to a decrease in pain intensity but no improvements in other aspects. When the effects of TTMW and ibuprofen were compared, statistically significant differences were found for all outcome measures ($p<0.05$) (Table 3).

DISCUSSION

The results show that TTMW is likely to be effective in reducing pain in patients with upper back pain associated with MTrPs. This is consistent with the findings reported elsewhere in the literature. For example, in a study investigating the use of a Thera Cane in patients with TrPs[6)], it was found that the application of ischemic pressure with the device was able to reduce pain when continued for 5 days

Table 2. Comparison of the outcome measures between baseline (pre-test) and post-test assessments in the TTMW and control groups (repeated measures ANOVA)

Outcome	Group	Baseline	Post-test 1	Post-test 2	Post-test 3
Pain intensity (VAS 0–10	TTMW	5.4 (0.2)	4.1 (0.2)*	2.8 (0.1)*	0.08 (0.1)*
cm), mean (SE)	C	5.2 (0.2)	4.9 (0.2)*	3.4 (0.2)*	1.8 (0.2)*
Pressure pain threshold	TTMW	1.9 (0.1)	2.7 (0.1)*	3.2 (0.1)*	3.9 (0.1)*
(PPT: kg/cm^2), mean (SE)	C	1.7 (0.0)	1.7 (0.1)	2.0 (0.0)*	2.5 (0.0)*
Tissue hardness (%),	TTMW	47.7 (1.2)	44.5 (1.2)*	42.1 (1.3)*	38.1 (1.4)*
Mean (SE)	C	46.0 (1.1)	46.0 (1.1)	45.4 (1.2)*	44.5 (1.2)*
Cervical range of motion					
Flexion (º), mean (SE)	TTMW	53.6 (1.7)	56.2 (1.7)*	58.7 (1.8)*	62.2 (1.5)*
	C	50.4 (2.1)	50.6 (2.1)*	52.7(2.1)*	54.7(2.1)*
Extension (º), mean (SE)	TTMW	56.2 (1.7)	59.7 (1.5)*	62.2 (1.3)*	66.3 (1.2)*
	C	52.7 (1.9)	52.7 (1.9)	54.6 (1.9)*	56.9 (1.8)*
Left lateral flexion (º)	TTMW	41.1 (1.5)	45.6 (1.5)*	49.6 (1.6)*	54.0 (1.6)*
Mean (SE)	C	39.5 (1.0)	39.6 (1.0)	41.3 (1.0)*	44.1 (0.9)*
Right lateral flexion (º)	TTMW	39.3 (1.2)	43.4 (1.3)*	46.2 (1.3)*	49.3 (1.3)*
Mean (SE)	C	36.2 (1.2)	36.4 (1.2)	39.1 (1.3)*	41.3 (1.4)*

TTMW: Wilai massage stick^{TM}; C: ibuprofen. *Significant improvement levels ($p<0.05$)

Table 3. Comparison of mean post-test measures at each assessment time point between the TTMW and control groups after adjustment for differences in baseline values (ANCOVA)

Outcome	Immediate effect: post-test 1			Short-term effect: post-test 2			Short-term effect: post-test 3		
	TTMW	C	Difference (95%CI)	TTMW	C	Difference (95%CI)	TTMW	C	Difference (95%CI)
Pain intensity (VAS 0–10 cm)	4.1	4.9	−1.0* (−1.4 to −0.6)	2.8	3.4	−0.7* (−1.1 to −0.3)	0.08	1.8	−1.1* (−1.6 to −0.6)
Pressure pain threshold (PPT: kg/cm^2)	2.7	1.7	0.8* (0.6 to −0.09)	3.2	2.0	1.0* (0.8 to 1.2)	3.9	2.5	1.3* (1.1 to 1.5)
Tissue hardness (%)	47.7	46.0	−3.0* (−4.0 to −2.0)	42.1	45.4	−4.8* (−6.1 to −3.5)	38.1	44.5	−7.9* (−9.7 to −6.1)
CORM Flexion (º)	56.2	50.6	2.4* (1.7 to 3.2)	58.7	52.7	2.8* (1.4 to 4.1)	62.2	54.7	4.6* (2.6 to 6.6)
Extension (º)	59.7	52.7	3.7* (2.5 to 4.9)	62.2	54.6	4.6* (3.2 to 6.0)	66.3	56.9	6.6* (4.9 to 8.2)
Left lateral flexion (º)	45.6	39.6	4.3* (3.9 to 4.7)	49.6	41.3	6.7* (5.5 to 7.7)	54.0	44.1	8.5* (6.8 to 10.2)
Right lateral flexion (º)	43.4	36.4	3.9* (3.0 to 4.8)	46.2	39.1	4.0* (2.7 to 5.3)	49.3	41.3	4.8* (3.2 to 6.4)

TTMW: Wilai massage stick^{TM} ; C: ibuprofen; CROM: cervical range of motion. *Significant difference between group ($p<0.05$)

followed by sustained stretching. In another study, use of activator TrP therapeutic equipment was found to be able to reduce pain in patients suffering from nonspecific neck pain with upper trapezius TrPs when 10 thrusts were performed at the rate of 1 thrust per second[10]. It should be point out, however, that those studies did not apply TTM principles and differed markedly from the present research in terms of the types of patients, body parts treated, pressure, treatment procedures, duration, and the equipment involved. A comparison of TTMW and ibuprofen revealed a statistically significant difference between the two types of treatment. Specifically, although both treatments were generally effective in treating patients with upper back pain associated with MTrPs, the former was found to contribute to greater pain reduction than the latter as shown in Table 3. The superior effectiveness of TTMW may be explained by the gate control theory, which postulates that the exertion of pressure through the skin and muscle tissues will stimulate pressure receptors, thereby blocking the gate transmitting pain nerve impulses at the spinal cord level[11]. This finding indicates the effectiveness of TTMW in increasing PPT, supporting the results of a study examining the effects of the Backnobber II on upper back TrPs when treatment is carried out in 30-second session 6 times every other day for 1 week[7]. In the present study, similar procedures were performed with the Wilai stick for massaging the upper back and shoulders (i.e.,

area where MTrPs are most felt), following TTM principles, in conjunction with muscle stretching. Such findings are not surprising as it has been reported that massage together with muscle stretching can relieve muscle tightness and aid muscles in returning to a normal state, thereby reducing pain sensitivity[12]. The results demonstrate that TTMW is effective in increasing flexion, extension, left lateral flexion, and right lateral flexion. The effects were felt immediately after the first treatment session and 1 day after the last treatment session. Even at day 5 after the last treatment session, the increase in extension and left lateral flexion remained high at 5° which was considered a clinically significant figure. This might be due to the relaxation effect of TTMW, which mobilizes the facet joints of the thoracic spine as well as the upper back and posterior neck muscles. On the other hand, ibuprofen did not bring about such results despite being able to alleviate pain, a finding consistent with that in past research reporting the effectiveness of pharmacological approaches in reducing pain, but not in increasing CROM[13]. This finding points to the effectiveness of TTMW in reducing tissue hardness. NSAIDs, such as ibuprofen, also lead to similar effects, but probably by a different mechanism. Specifically, they inhibit the production of prostaglandin, which in turn relieves inflammation and pain[14]. Furthermore, the action of drugs has systemic effects and involves pharmacological stimulation. On the other hand, TTM involves the stimulation of blood circulation and nerve endings, resulting in reflexive effects that reduce muscle contraction and hardness[15], a mechanism different from that associated with administration of drugs[16]. TTMW applies compression, i.e., the exertion of pressure on muscle fibers, along massage lines, which enhances the circulation of arterial blood to the massage area[17] and the removal of toxins from the affected areas through venous blood. This mechanism helps to relax muscle stiffness or tension and improve motion and flexibility. Also, sustained pressure, an inhibition technique, can block the transmission of nerve impulses and thus reduce muscle spasm. Traditional Thai self-massage was found to be a better alternative than pharmacological approaches in the treatment of patients with upper back pain associate with MTrPs. Based on the results of the present study, the procedures recommended to ensure the effectiveness of TTMW are as follows. TTMW is advice, but pressure is not necessary to be exerted directly on TrPs. In other words, patients should be instructed to use a Wilai stick™ to carry out self-massage without having to identify the TrP location. In addition, pressure should be gradually increased until mild pain is felt. Furthermore, massage should be done 5 times for each of the massage lines along the upper back area. Finally, pressure should be maintained for 5 seconds on each massage point to enhance muscle relaxation. One limitation of this research is that comparison with a group receiving a placebo treatment or not receiving any treatment at all could not be performed due to ethical requirements. Another matter of concern is the different skills of each patient in using a Wilai massage stick™. Finally, the results may involve some degrees of human error, as patients' perceptions of pain and PPT are subjective, varying from person to person.

The results of this study demonstrate the effectiveness of TTMW in the treatment of patients with upper back pain associated with MTrPs. Thus, it should be a viable alternative, especially for those suffering from adverse effects of anti-inflammatory drugs, as it poses little (minimal degree of muscle soreness in some patients) or no side effects risks. Further research along this line should examine the long-term effects of TTMW.

ACKNOWLEDGEMENTS

This study was supported by the Higher Education Research Promotion and National Research University Project of Thailand, Office of the Higher Education Commission, and the 90th Anniversary of Chulalongkorn University (Ratchadaphiseksomphot Endowment) Fund, Office of the Higher Education Commission, University Staff Development under High Education Research Promotion (USD-HERP), and the Thai Traditional Medicine Knowledge Fund.

REFERENCES

1) Travell JG, Simons DG: Myofascial pain and dysfunction: the trigger point manual. Baltimore: Williams &Wilkins, 1983.
2) Hong CZ: Myofascial trigger point injection. Cri Phys Reh Med, 1993, 5: 203–217.
3) Armstrong RB, Warren GL, Warren JA: Mechanisms of exercise-induced muscle fibre injury. Sports Med, 1991, 12: 184–207. [Medline] [CrossRef]
4) Travell JG, Simons DG: Myofascial pain and dysfunction: the trigger point manual. Baltimore: Williams &Wilkins 1989, pp 80–99.
5) Peungsuwan P, Sermcheep P, Harnmontree P, et al.: The effectiveness of Thai exercise with traditional massage on pain, walking ability and QOL of older people with knee osteoarthritis: a randomized controlled trial in the community. J Phys Ther Sci, 2014, 26: 139–144. [Medline] [CrossRef]
6) Hanten WP, Olson SL, Butts NL, et al.: Effectiveness of a home program of ischemic pressure followed by sustained stretch for treatment of myofascial trigger points. Phys Ther, 2000, 80: 997–1003. [Medline]
7) Gulick DT, Palombaro K, Lattanzi JB: Effect of ischemic pressure using a Backnobber II device on discomfort associated with myofascial trigger points. J Bodyw Mov Ther, 2011, 15: 319–325. [Medline] [CrossRef]
8) Wamontree P, Kanchanakhan N, Eungpinichpong W: Effects of traditional Thai self-massage using a massage stick versus Ibuprofen on upper back pain associated with myofascial trigger points: a pilot study. J Health Res, 2015, 29: 6.
9) Eungpinichpong W: Therapeutic Thai massage. Bangkok: Suweeriyasarn, 2008.
10) Blikstad A, Gemmell H: Immediate effect of activator trigger point therapy and myofascial band therapy on non-specific neck pain in patients with upper trapezius trigger points compared to sham ultrasound: a randomized controlled trial. Clin Chiropr, 2008, 11: 23–29. [CrossRef]
11) Melzack R, Wall PD: Pain mechanisms: a new theory. Science, 1965, 150: 971–979. [Medline] [CrossRef]
12) Simons DG: Understanding effective treatments of myofascial trigger points. J Bodyw Mov Ther, 2002, 6: 81–88. [CrossRef]
13) Heikkilä H, Johansson M, Wenngren BI: Effects of acupuncture, cervical manipulation and NSAID therapy on dizziness and impaired head repositioning of suspected cervical origin: a pilot study. Man Ther, 2000, 5: 151–157. [Medline] [CrossRef]
14) Maronde RF: Topic in clinical pharmacology and therapeutics. New York: Spinger Verlag, 1986.
15) Chaithavuthi J, Muangsiri K: Thai massage the Thai way in theory and practice. Bangkok: Nuntapun, 2005.
16) Wood EC, Becker PD: Beard's massage, 3rd ed. Philadelphia: W.B Saunders Company, 1981.
17) Travell JG, Simons DG: Myofascial pain dysfunction: the trigger point manual. Baltimore: Williams & Wilkins, 1992, 2: 94–177.