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Review Article

Soft Tissue Mobilizations as a Treatment for a Tension-Type Headache

Abstract

Background: A tension-type headache (TTH) is the most common form of a headache. The complex interrelation among the various pathophysiological aspects of TTH might explain why this disorder is so difficult to treat. Manual therapy is considered one of the main treatments for TTH. Massage therapy techniques, which act in part to increase blood flow to tissue, may reduce the activity of myofascial trigger points. Thus, it is possible that headaches originating from this etiology may be reduced with soft tissue mobilizations.

Aim: To perform a review of all available studies with an emphasis on randomized controlled trials to determine whether soft tissue therapy, such as massage and soft tissue inhibition, is a viable treatment for a tension-type headache.

Methods: PubMed, Google Scholar, Scopus, and PEDro databases were searched from inception until December 2016 for the following keywords: “massage”, “soft tissue therapy”, “soft tissue mobilization”, “trigger point therapy”, “a tension-type headache” or any combination of these words. The reference lists of all articles retrieved were searched as well. PEDro score was used to assess the quality of reviewed studies.

Results: A total of eleven studies were included in this review. Seven studies have examined the effect of soft tissue therapy alone with or without comparing to a placebo group and four studies examined this therapy compared to neural and spinal manipulation therapy and to the combination of both treatments. In all studies, soft tissue therapy has provided at least one or more positive effect on TTH patient’s outcomes.

Conclusions: Soft tissue mobilizations provide better outcomes for patients with TTH than ultrasound therapy or placebo. Headache frequency and intensity and headache disability inventory (HDI) scores can be decreased effectively using this therapy. However, the combination of soft tissue mobilizations with neural manipulation has a larger effect in reducing headache frequency and HDI scores in TTH patients than soft tissue mobilization alone. Therefore, soft tissue mobilization is a viable treatment for a tension-type headache, recommended to be combined with manipulation therapy in order to receive a greater therapeutic effect.

Abbreviations

HDI: Headache Disability Inventory; PPT: Pressure Pain Threshold; RCT: Randomized Controlled Trial; TrPs: myofascial trigger points; TTH: A Tension-Type Headache.

Background

A tension-type headache (TTH) is the most common form of a headache, and what many people consider as their ‘normal’ a headache, in contrast with a migraine. Episodic TTH is characterized by a bilateral, pressing, tightening pain of mild to moderate intensity [1]. Chronic TTH is a disorder that evolves from episodic TTH, with daily or very frequent episodes

of a headache lasting minutes to days. The 2004 International Headache Society criteria for chronic TTH are: headaches on 15 or more days a month (180 days/year) for at least three months; pain which does not worsen with routine physical activity (such as walking or climbing stairs); presence of no more than one additional clinical feature (mild nausea, photophobia, or phonophobia) and without moderate/severe nausea or vomiting [2]. Among many types of headache disorders, TTH is the most frequent in adults. Population-based studies suggest 1-year prevalence rates of 38.3% for episodic TTH and 2.2% for chronic TTH [3]. To quantify the impact of a headache on daily living, the Henry Ford Hospital has developed in 1994 a 25-item headache disability inventory (HDI). The alpha version of

the HDI (α -HDI) consisted of 40 items, each requiring a “yes” (four points), “sometimes” (two points), or “no” (zero points) response based on items derived empirically from case history responses of subjects with a headache. The HDI is useful in assessing the impact of a headache, and its treatment, on daily living [4].

The exact pathogenesis of TTH remains unclear. Whether TTH originates from peripheral myofascial mechanisms or central mechanisms in the brain is still a matter for debate [5]. The supposition that the pain of TTH is muscular in origin and related to increased resting muscle tension corresponds with the current clinical understanding of a tension-type headache and derived treatment approaches [6]. It has been demonstrated that the most prominent clinical finding in both adults and children suffering from TTH is an increased tenderness to palpation of pericranial tissues and neck muscles and their tendon insertions [7]. The muscle painful points detected in TTH are classified as tender points or myofascial trigger points (TrPs). Tender points are muscle points that produce spontaneous or provoked local pain, while TrPs are painful muscle points that, when compressed or stretched, provoke pain both locally and at a distance from the stimulated site (i.e., referred pain) [7]. There is scientific evidence showing the relevance of TrPs in several headaches, particularly TTH [8]. Chronic TTH subjects with active TrPs in sternocleidomastoid, trapezius, or temporalis muscles report greater headache intensity and longer headache duration than those with latent TrPs in the same muscles [9]. Also, active TrPs are much more frequent in patients with chronic TTH than in controls and the number and pain intensity of Trp can be used to distinguish between the two groups [10]. At Fernández de las Peñas et al. updated pain model, chronic TTH has been proposed in which a headache can be at least partly caused by referred pain from active TrPs in the posterior cervical, head and shoulder muscles mediated through the spinal cord and the brainstem trigeminal nucleus caudalis. In this updated pain model, TrPs would be the primary hyperalgesic zones responsible for the development of central sensitization in chronic TTH [11]. The complex interrelation among the various pathophysiological aspects of TTH might explain why this disorder is so difficult to treat, and various therapeutic approaches should be used in sequence or in combination [12].

Manual therapy is considered one of the main treatments for TTH. It is based on the evaluation and analysis of neuromusculoskeletal dysfunctions and treatment through muscle and joint manipulations. There is a wide range of manual therapy treatments used in physiotherapy [13]. It has been found in several studies that cervical exercises, relaxation, massage, postural exercises, craniocervical techniques, thermotherapy, vertebral mobilization, and stretching are effective in reducing TTH symptoms such as pain frequency and intensity [13]. In a clinical survey, it was found that chronic TTH patients prefer complementary and alternative practitioner-administered physical treatments to self-treatments, the most frequently used being chiropractic (21.9%), acupuncture (17.8%), and massage (17.8%) [14]. Massage therapy techniques, which act in part to increase blood flow to tissue, may reduce the activity

of a TrP. Thus, it is possible that headaches originating from this etiology may be reduced with massage therapy [15].

This is a review of all available studies with an emphasis on randomized controlled trials (RCT) to determine whether soft tissue therapy, such as massage and soft tissue inhibition, is a viable treatment for a tension-type headache.

Methods

PubMed, Google Scholar, Scopus, and PEDro databases were searched from inception until December 2016 using predefined search strategies. The databases were searched for the keywords “massage”, “soft tissue therapy”, “soft tissue mobilization, “trigger point therapy”, “a tension-type headache” or any combination of these words. The search was run by two reviewers independently. Disagreements were resolved by discussion between the two authors. The search results were pooled and duplicates removed. The titles and abstracts of all articles were reviewed. Criteria for inclusion in the review were studies investigating the soft tissue mobilizations for TTH. Trials of any methodological quality and only trials written in English were included in the review. The reference lists of all articles retrieved in full were also searched.

The methodological quality of interventional studies is evaluated by the PEDro score (<http://www.pedro.org.au/>). We used the scores found in PEDro website. The PEDro scale considers two aspects of trial quality, namely the “internal validity” of the trial and whether the trial contains sufficient statistical information, thus making it interpretable. It does not rate the “external validity” of the trial or the size of treatment effect.

Results

The literature search identified eight RCTs, one unrandomized controlled study and two pilot studies that examined the effects of different methods of soft tissue mobilizations on TTH (Tables 1,2).

The pilot quasi-experimental pre-post designed study of Moraska et al. [16], tried to assess short-term changes in pain measures in 18 patients with TTH receiving massage therapy focused on TrPs. A 3-week baseline period preceded six weeks of massage when each patient received two 45-minute massage sessions each week and a 3-week follow-up period. Headache duration was reported as the average of 4.7 ± 0.7 days per week with a headache during the 3-week baseline period. A significant reduction in headache incidence was detected during the massage phase (3.7 ± 0.9) ($f(3,5)=8.95$, $p<0.001$) and the 3-week follow-up (3.2 ± 1.0). Headache pain during the baseline period was of moderate intensity but decreased by 30% over the course of the study and also headache duration decreased from 4.0 ± 1.3 hours in the baseline period to 2.8 ± 0.5 hours for the follow-up phase ($f(3,45)=3.17$, $p<0.05$). A corresponding improvement in HDI was found with massage ($f(3,45)=14.1$, $P<0.001$).

In the Espi-Lopez et al. study [17], 102 patients with TTH were divided into two groups in order to compare the effect of

Table 1: Characteristics of the reviewed studies.

Study	Design	Treat. group (N)	Type of therapy for treat. group	Control group (N)	Age	Sex (female)	Number of procedures	Procedures per week	Duration of session (min)
Moraska et al. 2008	Quasi-experimental	16	Massage	-	43±9.3	12	12	2	45
Espí-Lopez et al. 2016	RCT	51	Massage	-	38.9±10.9	79	4	1	20
		51	Massage+ MOAA						
Berggreen et al. 2012	RCT	19	TrP Massage	16	38.8±13.7	35	10	1	individual
Moraska et al. 2015	RCT	17	TrP Massage	20	32.1±12.0	48	12	2	45
		19	US (placebo)						
Chatchawan et al. 2013	RCT	36	TrP Massage (TTM)	-	27.39±6.73	55	9	3	30
		36	US						
Ajimsha 2011	RCT	22	DT-MFR	12	43.8±5.4	36	24	2	60
		22	IDT-MFR						
Toro-Velasco et al. 2009	Pilot RCT	11	TrP massage	-	51±15	8	2	1	40
Espí-Lopez et al. 2014	RCT	19	SSI	19	39.9±10.9	62	4	1	10
		19	MOAA						
		19	SI+MOAA						
Espí-Lopez et al. 2013	RCT	20	SSI	22	39.7±11.4	68	4	1	10
		20	MOAA						
		20	SSI+MOAA						
Ferragut-Garcias et al. 2016	RCT	23	STM	24	39.7±11.5	78	6	1/2	15
		25	NMT						
		25	STM+NMT						

US- Ultrasound; TrP- Trigger Point; MOAA- Manipulative treatment of Occiput, Atlas and Axis; SSI- Sub-occipital Soft tissue Inhibition; STM- Soft Tissue Mobilization; NMT- Neural Mobilization Techniques; DT-MFR- Direct Technique Myofascial Release; IDT- MFR- Indirect Technique Myofascial Release; TTM- Thai Traditional Massage; CS- Cross-Sectional Study; RCT-Randomized Controlled Trial.

spinal manipulation combined with massage versus massage alone on a range of motion of the cervical spine, headache frequency, intensity, and disability. The focus of this study range was the spinal manipulations, therefore we used only data from the control group that received the massage alone. Four treatment sessions were conducted over four weeks and patients were evaluated at baseline, immediately after the intervention and at a follow-up, eight weeks after completing the intervention. Massage alone group demonstrated a large ($f=1.22$, $p<0.05$) improvement in all four subscales of the HDI score (frequency, severity, emotional, and functional). Two above studies showed that massage is effective in improving symptoms of TTH, however, their design not allows ruling out the spontaneous improvement and placebo effect.

In Berggreen's et al. RCT [18], 35 females with chronic TTH were divided into a TrPs massage group and a control group (receiving no treatment) to evaluate the efficacy of TrP massage in the muscles of the head, neck, and shoulders regarding pain in the treatment of chronic TTH. Each patient received 10 treatments. The tissue and the muscles were treated using identical massage methods (friction) on the myofascial TrPs. Each point was treated for 2 – 5 min at each treatment with ischemic compression. A significant improvement in morning pain was recorded in the treatment group compared with the control group (difference of the change: 8.8 (95% CI 0.11–17.4), $f=4.220$, $p=0.047$). Furthermore, a significant decrease in the

number of trigger points was observed in the treatment group compared with the control group ($f=37.732$, $p<0.0001$). This high-quality RCT (PEDro score 7/10), showed that massage is superior to no treatment (effect of time), but still did not allow comparison to the placebo effect.

In a placebo-controlled RCT performed by Moraska et al. [19], massage focused on TrPs and detuned ultrasound as placebo were applied on 56 patients with TTH in order to assess the efficacy of massage in reducing headache pain. Massage and placebo session were 45 minutes, twice a week for 6 weeks. Headache frequency decreased from baseline for both massage ($p<0.0003$) and placebo ($p=0.013$) groups, but no difference was detected between the groups. Patient report of perceived clinical change was a greater reduction in headache pain for massage than placebo or wait-list groups ($p=0.002$). Pressure pain threshold (PPT) improved in all tested muscles only in massage group (all p 's <0.002). Significant condition effects were observed on changes in HDI ($f(4,52) = 3.26$, $p = 0.019$). Post-hoc tests showed a significant decrease in HDI scores in the intervention group ($p = 0.0003$) but not in the placebo ($p = 0.06$) or wait-list ($p = 0.39$) groups.

In the RCT ran by Chatchawan et al. [20], the effects of Thai traditional massage on PPT and headache intensity in patients with chronic TTH and migraine headaches was investigated. Thai massage is a form of deep massage with

Table 2: Studied variables and findings.

Study	Outcomes	Findings short term(end of treatment)	Findings long term	PEDro score
Moraska et al. 2008	HA frequency (days/week)	Decreased 21%*	Decreased 31%*	-
	HA intensity (VAS 0-100 mm)	Improvement 11.3mm*	Improvement 10.3*	
	HA duration (hours)	Decreased 20%*	Decreased 24%*	
Espí-Lopez et al. 2016	Frequency HDI	Combined>Massage*	Combined>Massage*	7/10
	Intensity HDI	Combined=Massage*	Combined=Massage*	
	Functional HDI	Combined=Massage*	Combined=Massage*	
Berggreen et al. 2012	VAS pain morning	Decreased 42%*	-	7/10
	VAS pain evening	Decreased 36%*		
	Number of TrP	Decreased 66%*		
Moraska et al. 2015	HA frequency (days/week)	Massage=Placebo*	Massage=Placebo*	6/10
	HA intensity (VAS)	Massage=Placebo*	Massage>Placebo*	
	HDI	Massage>Placebo*	Massage>Placebo*	
Chatchawan et al. 2013	HA frequency (days/week)	Massage>Placebo*	Massage>Placebo*	8/10
	HA intensity (VAS)	Massage=Placebo*	Massage=Placebo*	
	HA duration (hours)	Massage>Placebo*	Massage>Placebo*	
	PPT	Massage>Placebo*	Massage>placebo*	
Ajimsha 2011	HA frequency (days/month)	DT-MFR>IDT-MFR	-	6/10
Toro-Velasco 2009	PPT	No change	-	6/10
	NPRS	Decreased 24%*		
Espí-Lopez et al. 2014	Frequency HDI	MOAA>combined>SSI*	-	7/10
	Severity HDI	MOAA>combined>SSI*		
	Overall HDI	Combined=MOAA>SSI*		
Espí-Lopez et al. 2013	Global HDI	Combined=MOAA>SSI*	Combined>MOAA>SSI*	5/10
	Functional HDI	Combined>MOAA>SSI*	Combined>MOAA>SSI*	
	Emotional HDI	MOAA> Combined >SSI*	MOAA> Combined >SSI*	
Ferragut-Garcias et al. 2016	HA frequency (d/15)	Combined>NMT=STM*	Combined>NMT=STM*	7/10
	HA intensity (1-10)	Combined>STM>NMT*	Combined>STM>NMT*	

HA- a headache; VAS- Visual Analogue Scale; HDI- headache disability inventory; PPT- Pressure-pain threshold; NPRS- numerical pain rate scale; MOAA- manipulative treatment of occiput, atlas, and axis; SSI- sub-occipital soft tissue inhibition; STM- soft tissue mobilization; NMT- neural mobilization techniques; DT-MFR- direct technique myofascial release; IDT- MFR- indirect technique myofascial release.

*Compared to baseline measurements

brief sustained pressure (5–10 seconds per point) in specific TrPs and in a surrounding area of these points in the whole muscle. 72 patients were randomly assigned to a treatment group (Thai massage) or a sham ultrasound (placebo) group and received nine sessions each during a period of three weeks. After the treatment and at three and nine weeks of follow-up, the Thai massage group showed a significant increase in PPT ($p < 0.01$) compared with the sham ultrasound group. In both groups, headache intensity decreased significantly ($p < 0.05$) at every end point of the outcome measures, and there were no differences between the groups ($p > 0.05$).

Ajimsha's et al RCT [21], came to investigate whether direct technique myofascial release reduces the frequency of TTH more effectively than the indirect technique myofascial release in comparison to a control group receiving slow soft stroking. The techniques were administered by certified myofascial release practitioners and consisted of 24 sessions per patient over 12 weeks. The number of days with a headache per 4 weeks decreased by 7.1 ± 2.6 days in the direct technique group

compared with 6.7 ± 1.8 days in the indirect technique group and 1.6 ± 0.5 days in the control group, ($p < 0.001$). Patients in the direct technique group, indirect technique group, and control group reported a 59.2%, 54% and 13.3% reduction in headache frequency in weeks 17–20 compared to that in weeks 1–4.

In Toro-Velasco's et al. pilot cross-over design RCT [22], 11 patients received either the experimental treatment (massage protocol) or a placebo intervention (detuned ultrasound) in order to investigate the immediate effects of head-neck massage on heart rate variability, mood states, and PPTs in patients with chronic TTH. Each patient attended two treatment sessions where they were randomly assigned to one of the interventions at each visit, each session lasted approximately 40 minutes. Pairwise comparisons showed that head pain, measured by numerical pain rating scale, decreased 24 hours after manual therapy ($p < 0.05$) but not after the placebo intervention ($p = 0.9$). On the other hand, no significant changes were found in PPT levels (right F = 0.3, $p = 0.6$, left F = 0.4, $p = 0.5$). All four

aforementioned good quality (PEDro scores $\geq 6/10$) placebo-controlled RCTs showed that soft tissue treatments were superior to placebo in treating different aspects of TTH.

At the four following studies, the effect of soft tissue mobilizations as monotherapy was compared to neural and spinal manipulation therapy and to the combination of treatments. In the first study [17], 102 patients with TTH were divided into two groups in order to compare the effect of spinal manipulation combined with massage versus massage alone on a range of motion of the cervical spine, headache frequency, intensity, and disability. Four treatment sessions were conducted over four weeks and patients were evaluated at baseline, immediately after the intervention and at a follow-up, eight weeks after completing the intervention. Both groups demonstrated a large ($f=1.22$) improvement on their HDI scores. Those that received manipulation reported a medium-sized reduction ($f=.33$) in headache frequency across all data points ($p<0.05$) compared to the massage group

In the second and third studies conducted by Espi-Lopez et al. [23,24], patients were randomly divided into four treatment groups: 1) suboccipital soft tissue inhibition; 2) occiput-atlas-axis manipulation; 3) combined treatment of both techniques; 4) control, in order to assess the effectiveness of manual therapy techniques on aspects of disability in patients with TTH. In the second study [23], 76 patients have received four sessions over four weeks and disability was assessed before and after treatment using the HDI scores. Headache frequency was significantly reduced with the manipulative and combined treatment ($p<0.05$), and the severity and functional subscale of the HDI changed in all three treatment groups ($p<0.05$). The combined intervention showed a greater effect of reducing the overall HDI score compared to the group that received suboccipital soft tissue inhibition and to the control group (both $p<0.05$). In the third study [24], 82 patients were assessed before and after treatment using the HDI scores and a weekly self-record of a headache and associated symptoms. In the month prior to the study, average pain intensity, was rated at 6.49 (SD 1.69), and 66.7% subjects suffered headaches of moderate intensity. After eight weeks, statistically significant improvements were noted. Occiput, atlas, and axis manipulative treatment and combined therapy treatments proved to be more effective than suboccipital soft tissue inhibition for TTH ($p<0.05$).

In the study of Ferragut Garcias et al. [25], 97 patients were randomly assigned into 4 groups in order to evaluate the effects of a protocol involving soft tissue techniques and/or Neural Mobilization Techniques in the management of episodic and chronic TTH. The three groups who received the intervention had an increase of PPT and a reduction in frequency and intensity in all time-points after the intervention compared to baseline and to the control group ($p<0.001$). The application of soft tissue techniques and neural mobilization induces significant changes in PPT, the characteristics of the pain crisis, and its impact on daily life activities compared to the application of these techniques as isolated interventions.

Discussion

This review, evaluating the efficiency of soft tissue therapy for patients with TTH, has included eleven studies. The soft tissue techniques used in the studies were massage and soft tissue mobilization [16-20,22,25], suboccipital soft tissue inhibition [23,24], and direct technique myofascial release [21]. In all studies, soft tissue therapy has provided at least one or more positive effect on TTH patient's outcomes.

Seven studies have examined the effect of soft tissue therapy alone with or without comparing to a placebo group [16-22]. According to the reviewed data, soft tissue mobilizations showed better outcomes for patients with TTH than sham ultrasound therapy or placebo. Headache frequency and intensity and also HDI scores have decreased in all these studies in short and long term. This finding compatible with another review [26], which found that patients with TTH receiving manual therapy show more favorable outcomes than patients receiving the standard treatment or a placebo. Manual therapy seems to reduce headache frequency and intensity and improve patients' quality of life but does not lead to a decrease in analgesic use.

At the four remaining studies [17,23-25], the effect of soft tissue therapy, such as massage and suboccipital soft tissue inhibition and mobilization, was examined compared to neural and spinal manipulation therapy and also compared to the combination of both treatments. In these studies, the combined therapy of soft tissue with manipulation had a larger effect on headache frequency and HDI scores than soft tissue therapy alone. In two of these studies [23,24], the improvement on overall HDI scores was similar in the occiput-atlas-axis manipulation group and the combined therapy group- this may indicate that the effect of soft tissue therapy in the combined therapy is less significant than the effect of spinal manipulation therapy. On the other hand, in the fourth study [25], headache frequency has decreased similarly in the manipulation therapy group and the soft tissue therapy group. Also, the effect on headache intensity was larger in the soft tissue therapy group compared to the manipulation group.

It is important to note that the reviewed studies included different outcome measures. The HDI was the most common tool used, but also headache diaries, PPT, the Headache Impact Test and medicine consumption.

Conclusions

According to this review, soft tissue mobilizations provide better outcomes for patients with TTH than placebo. Headache frequency and intensity and HDI scores can be decreased effectively using this therapy. However, the combination of soft tissue therapy with neural manipulation has a larger effect in reducing headache frequency and HDI scores in TTH patients than soft tissue mobilization alone. Therefore, soft tissue mobilization is a viable treatment for a TTH, recommended to be combined with manipulation therapy in order to receive a greater therapeutic effect.

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