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Mini Review

Are Vertebral Mobilization and Manipulation More Effective than Other Manual Therapy Techniques for Managing Tension Type Headache?

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Received: January 29, 2018; **Published:** February 22, 2018

Abstract

Tension type headache is the most common primary headache disorder affecting the general population, and it is associated with a substantial amount of disability and socioeconomic burden. In spite of the broad impact of tension type headache, many people do not receive professional medical attention for the disorder, and often self-treat with analgesics. Non-pharmacological treatments, such as vertebral mobilization and/or manipulation or myofascial release, may be incorporated into a physical therapy regimen for treating symptoms of tension type headache. Existing reviews have compared manual therapy techniques to pharmacologic interventions or receiving no treatment at all. The purpose of the present review is to investigate the effectiveness of manipulation and/or mobilization techniques for treating the manifestations of tension type headache as compared to other forms of manual therapy, such as myofascial release or manual traction. A review of the literature from was conducted from Cochrane, CINAHL, EBSCO, Pubmed, PEDro, and Google Scholar. Based on inclusion and exclusion criteria, seven studies were included for review. Findings were generally favorable and did not indicate the superiority of a single technique.

Keywords: *Tension Type Headache; Manipulation; Mobilization; Manual Therapy; Headache Intensity; Headache Frequency*

Abbreviations

TTH: Tension Type Headache; OTC: Over the Counter; WHO: World Health Organization; ROM: Range of Motion; TrPs: Myofascial Trigger Points; HVLA: High Velocity Low Amplitude; RCT: Randomized Controlled Trial; ETTH: Episodic Tension Type Headache; CTTH: Chronic Tension Type Headache; MT: Manual Therapy; EMG: Electromyography; VAS: Visual Analog Scale; PPT: Pain Pressure Thresholds; HI: Headache Index; CTM: Connective Tissue Manipulation; NPRS: Numeric Pain Rating Scale; SI: Suboccipital Inhibitory; OAA: Occipitoatlantoaxial; SM: Suboccipital Manipulation

Introduction

Tension type headache, commonly referred to as "stress headache" is the most common form of headache [1,2], with episodic TTH affecting between 30 - 78% of the general population [3]. The worldwide prevalence is around 40%, with women more commonly affected than men [4,5]. Chronic TTH, a more debilitating disease, affects 1 - 3% of adults [4]. In spite of its widespread prevalence, the underlying mechanism for tension type headache is still poorly understood [3,4]. The etiology behind this disorder may be stress related, musculoskeletal, or neurobiological in nature [1,3,4].

Symptoms of TTH are non-specific, non-vascular, non-migrainous [2]. These headaches typically present with contraction of pericranial, suboccipital, and cervical muscles; and individuals report experiencing bilateral pain and "tightness" in head and/or neck [3,4]. The most common abnormal finding in individuals with tension type headache is increased pericranial tenderness with manual palpation, which positively related to headache frequency and intensity [3]. Palpation of the frontal, temporal, masseter, pterygoid, sternocleidomastoid, splenius and trapezius muscles may reveal local tenderness which can be exacerbated during the presence of headache [3].

There are three recognized classifications of TTH, which differ in frequency, severity, and possibly underlying mechanisms. Infrequent episodic TTH is extremely common and symptoms are temporary, with a duration of minutes to a few days [3,4]. The onset of these headaches is believed to be due to stress, anger, anxiety, or fear [2] and they are experienced by most of the general population [3]. These headaches are typically experienced less than one day per month, may not present with increased pericranial tenderness, and do not require medical attention [3]. Frequent episodic TTH presents with the same symptoms as infrequent TTH, but headaches are present between 1 - 14 days per month for > 3 months and may coexist with migraine without aura. Frequent episodic TTH may evolve into chronic TTH, the most severe manifestation of TTH. Chronic TTH are daily headaches that vary over the course of 24 hours but do not cease with medication [2,4]. These headaches are present > 15 days per month for > 3 months and are associated with a high degree of disability [3]. The chronic TTH subtype commonly occurs with insomnia, feelings of guilt, stress, anxiety, depression, weight loss, and nausea [2]. Peripheral pain mechanisms are believed to be responsible for frequent and infrequent TTH, and central pain mechanisms play a larger role in chronic TTH [3].

Tension type headache could impact social functioning, psychological and emotional well-being, and quality of life [6-8]. A diagnosis of chronic TTH may be associated with psychological comorbidities of anxiety and depression. One study found that individuals with chronic TTH were between 3 - 15 times more likely to receive a diagnosis of anxiety or a mood disorder compared to controls, and nearly half of the subjects with TTH suffered from significant anxiety or depression. A 2016 study revealed the prevalence of anxiety (9.5% vs 5.3%, $p = 0.001$) and depression (4.2% vs 1.8%, $p = 0.001$) is higher among individuals with TTH than those who do not suffer from headache [9]. Furthermore, individuals who experience anxiety and depression were found to suffer from heightened symptoms among people with TTH [9].

Prevalence of TTH is highest during the most productive years in life [8], and there is a large economic burden associated with the disorder. Symptoms impact ability to participate at work and school and may lead to absences and/or presenteeism [10]. Presenteeism, which refers to attending work while ill [11], can be associated with lost productivity and economic costs. Frequent and chronic TTH is associated with a much more substantial level of disability than infrequent TTH [3], although episodic TTH may still have an important effect on productivity. One study found that students with episodic TTH were 24.4% less productive when in pain [12]. A large population-based study found that 43% of subjects with episodic tension-type headache reported decreased effectiveness at work, home, or school, and 8.3% reported missed work days due to headache [5]. However, subjects with chronic TTH reported more lost workdays than those with the episodic presentation, averaging 27.4 days versus 8.9 days, and more decreased effectiveness days, averaging 20.4 days compared to 5 days [5].

In addition to lost productivity and missed work, there are a number of costs associated with treating TTH. A large Canadian study found the medical consultation rate among individuals with TTH is 45%, and that of individuals who sought medical care 32% received ongoing treatment. Eight percent of respondents with TTH sought care in the emergency department [13]. Although there are costs associated with medical consultation, additional costs are attributed to self -treating and analgesic use. Globally, up to 50% of people with headache disorders self-treat [1,4], which implies many people may not be using the most effective methods for managing symptoms. Individuals with TTH frequently manage symptoms with OTC analgesics [1], although chronic TTH may be treated with amitriptyline [2] and frequent episodic TTH may require expensive prescription medications [3].

Although OTC medications may be appropriate for managing episodes of TTH, there can be risks associated with over-reliance on analgesics and adverse consequences of frequent medication use. Medication overuse headache is an avoidable form of headache that typically originates with a presence of episodic TTH or migraine consistently managed with medication [4]. Analgesic use increases with headache frequency, until symptoms are constant in spite of frequent doses [4]. Many individuals seek non-pharmacologic alternative and complementary treatments to manage symptoms of TTH, rather than relying solely on medications. The WHO found that physical therapy (44%), acupuncture (39%), and naturopathy (25%) were the most common methods employed globally to treat headache, including TTH [4].

Since physical therapy is a popular method for managing TTH, it is important to consider the efficacy of the interventions frequently used in a physical therapy regimen. Clinicians often incorporate the use of manual therapy techniques into their plan of care to address symptoms of muscle tightness, tenderness, decreased ROM, and TrPs that commonly present with TTH [14]. Manual therapy techniques may include myofascial release, manual traction, vertebral mobilizations and/ or HVLA thrust manipulations, massage and muscle energy techniques [14]. Existing reviews have examined the overall effectiveness of physical therapy and/or manual therapy for treating TTH [14-16] or have examined the effectiveness of multimodal manual therapy techniques as compared to pharmacologic interventions [17]. The present review seeks to compare manual therapy techniques of vertebral mobilization and/or manipulation to other manual therapy techniques, such as myofascial release or manual traction, in order to determine the most effective manual interventions physical therapists can use to treat patients with TTH.

Methods

Two authors conducted literature searches to identify studies on the effect of manual therapy interventions in reducing headache symptoms and frequency in patients with episodic and chronic TTH. The databases searched included Cochrane, CINAHL, EBSCO, Pubmed, PEDro, and Google Scholar. The following search terms were used: tension type headache AND manual therapy, tension headache AND physical therapy, tension type headache AND manipulation, tension type headache AND mobilization, tension type headache AND non-pharmacologic treatment, and tension type headache AND conservative treatment.

Selection of Studies

Studies meeting the following criteria were considered for review: (1) RCT; the study contained at least two groups that were randomly assigned to either a HVLA manipulation or mobilization group or a comparison group that received another form of manual therapy or hands-on technique; (2) the subjects must have a diagnosis of chronic or episodic tension type headache; (3) the study included pain, headache frequency, intensity, duration, or quality of life as outcome measures. Exclusion criteria included: (1) Subjects were diagnosed with a different form of headache; (2) studies not appearing in peer reviewed journals; (3) studies did not include pre and post-tests in their outcome measures; (4) studies that only compared manual therapy techniques to a pharmacologic intervention; (5) studies that were not published in English. Based on the inclusion and exclusion criteria, seven studies were selected for review.

Characteristics of Studies

The characteristics of the seven studies included in this review are summarized in table 1. In all of the studies at least one experimental group received vertebral mobilizations Grades I-IV or a HVLA vertebral manipulation, which may have been combined with another intervention. The comparison groups all received some form of manual therapy intervention, and three studies also had a control group that received a placebo intervention or no treatment at all.

Study	Subjects	Episodic or Chronic TTH	Experimental Intervention	Control or Comparison Intervention	Time of Follow Up	Outcome Measures	Pedro Score
Bove and Nilson (1998)	N = 71; n = 36 manipulation and soft tissue therapy group; n = 34 soft tissue therapy (control group)	Episodic TTH	Spinal manipulation and soft tissue therapy (including deep friction massage and trigger point therapy); 8 treatments over 4 weeks after 2 week baseline	Soft tissue therapy (including deep friction massage) and a placebo laser treatment; 8 treatments over 4 weeks after 2 week baseline	1, 5, 9, 13 weeks after the intervention	Daily hours of headache, pain intensity per episode, and daily analgesic use as recorded in diaries	8/10
Demiturk., *et al.*. (2002)	N = 30; n = 15 cervical mobilization group, n = 15 connective tissue manual therapy group	Chronic TTH	Cyriax cervical mobilization; three times per week for one month	Manual therapy to connective tissue; twenty 30-minute treatments over 4 weeks	Immediately post-intervention and at 1-month follow up	Headache Index Values, Active Cervical ROM**, Pressure Pain Threshold values	5/10
Donkin., *et al.* (2002)	N = 30	Not specified	Spinal Manipulation and Traction, two-three sessions per week over four weeks (max nine treatments)	Spinal Manipulation, two-three sessions per week over four weeks (max nine treatments)	Post intervention and at 1-month follow up	Frequency, Intensity, Duration, cervical ROM, CMCC Neck Disability Index, Numeric Pain Rating Scale, Short From McGill Pain Questionnaire, Headache Diary	4/10

Espi-Lopez., *et al.* (2014)	N = 81; manipulation (n = 20), Manipulation and suboccipital manual therapy (n = 20), Manual therapy only (n = 20), Control (n = 21)	Not specified	OAA*** Manipulation; OAA manipulation and Manual therapy of sub-occipital muscles; Manual therapy of sub-occipital muscles; one treatment per week over four weeks	Control group (No Treatment)	8-week follow up	Pain perception (Mc Gill Pain Questionnaire), Cervical ROM, Frequency, Intensity	5/10
Espí-Lopez, Zurriaga-Llorens, Monzani, Falla (2016 a)	N = 102 completed	Frequent TTH = 47.6% and chronic TTH = 52.4%	OAA Manipulation and massage; 4 treatment sessions over 4 weeks, each lasting 20 minutes	Massage only (same dosage as intervention)	Baseline, post-intervention and at 8-week follow up	HDI****, Cervical ROM, and Upper -Cervical ROM, Headache frequency	Not yet assessed
Espi-Lopez, Rodriguez-Blanco, Olivia-Pascual-Vaca, Molina-Martinez, Falla (2016 b)	N = 76	Episodic (59.2%) and Chronic TTH (40.8%)	Sub occipital inhibitory pressure; Sub occipital manipulation; or Sub occipital Inhibitory pressure and manipulation; Four 20-minute treatments over four weeks	Control group received no treatment but attended the same number of sessions and had the same tests performed	Baseline, at 4 weeks, and one month after completing the intervention	Quality of Life, Pain	4/10
Hoyt., *et al.* (1979)	N = 22	Not specified	Group 1 = HVLA* manipulation and soft tissue manual therapy, Group 2 = HVLA manipulation	Controls rested in supine position for 10 minutes	Immediately post-intervention	EMG level in the frontalis muscle, temperature in the dominant hand, and Subjective evaluations of headache on a scale of 0-7	3/10

Table 1

** HVLA = High velocity low amplitude*

***ROM = Range of motion*

****OAA = Occipitoatlantoaxial joint*

*****HDI = Headache Diary Index*

A total of 412 subjects were included in the seven studies. Two studies included participants with both ETTH and CTTH, one study included only participants with ETTH, one study included only those with CTTH, and three studies did not specify whether the condition was chronic or episodic. All studies included both male and female participants, with ages that ranged from 15 to 65 years old.

The studies varied in their comparison interventions, duration, frequency of treatment, and outcome measures. Outcome measures were assessed at baseline and immediately post-intervention. Six of the studies conducted follow-ups between one month and 13 weeks post-intervention. Researchers in six studies performed treatment sessions between one and five times per week over a 4-week duration. Interventions typically lasted 15 - 20 minutes.

The most frequently used comparison intervention was MT to soft tissue, six of the studies included some form of soft tissue MT and the techniques included deep friction massage targeting TrPs [18], connective tissue manipulation targeting fascia [19], suboccipital muscle inhibition [20,21], superficial massage [22] and soft tissue palpation [23]. Four of these six studies included outcome measures to assess the effects of manual therapy on pain, three examined cervical ROM, and three assessed frequency and/or duration. Other variables that were examined included disability related to headache, analgesic use, quality of life, and EMG of cranial musculature. The remaining study [24] compared the effects of manual traction to vertebral manipulation on outcomes measuring pain, neck disability, headache frequency, intensity, and duration.

Results

Pain and headache intensity

Bove and Nilsson (1998) compared soft tissue MT combined with manipulation to soft tissue MT and a placebo laser intervention for individuals with ETTH. During the 19-week study, subjects received eight treatments over four weeks. Pain intensity was measured on a VAS at weeks 7, 11, 15 and 19. There were no differences among groups at any point for pain intensity.

Demiturk., *et al*. [19] assessed pain severity, PPT, and headache index among subjects with CTTH. The HI value accounts for both pain severity and frequency. This study compared the effects of Cyriax's vertebral mobilization and CTM targeting the skin and fascia. Subjects in the CTM group received 20 treatments, each lasting 30 minutes, over four weeks. Subjects in the mobilization group received treatment three times per week for four weeks. There was significant decrease in HI values and increase in PPT for both groups immediately following the intervention ($p < 0.05$), but there was no difference between the two groups. There was no difference for pain severity measured by VAS.

Donkin., *et al*. [24] compared the effects of manual traction plus vertebral manipulation to vertebral manipulation alone on variables including pain and intensity. Subjects received a maximum of nine treatments over four weeks. Pain was measured by the McGill Short Form Pain Questionnaire and the NPRS, and intensity was recorded in a headache diary. Both groups experienced a significant reduction in the McGill and NPRS pain assessments (manual traction plus manipulation: $p = 0.0162$ and $p = 0.0098$; manipulation only: $p = 0.0098$ for both). Between groups, the manipulation only group had significantly lower scores on the NPRS than the combined treatment group ($p = 0.0428$). Furthermore, the manipulation only group reported a significant decrease in headache intensity ($p = 0.0019$), while there was no difference for the combined treatment group. These differences were not present at a 1-month follow up. This suggests manipulation alone may confer more short-term benefits than manipulation combined with manual traction.

Espí-Lopez and Gomez-Conesa [20] investigated the effects of manual therapy SI, OAA manipulative therapy, and a combination of the two interventions. Pain intensity was assessed using the NPRS and pain perception was measured with the McGill Pain Questionnaire. All groups, including controls, demonstrated improvements in the McGill Pain Questionnaire post-intervention and/or at the follow up. However, the manipulation only group was the only group to have significant improvements in all McGill dimensions at both assessments. Headache intensity significantly improved for all groups, except SI only, and these improvements were maintained at follow-up ($p < .03$ for all).

Hoyt., *et al*. [23] investigated the effects of palpation for axial restriction, palpation combined with osteopathic manipulation, and a control group that received no hands-on assessment. There were significant differences between the groups ($F = 17.6$, $df = 2/19$, $p < 0.0001$) and the combined palpation and manipulation group reported a significant decrease in pain following the intervention ($t = 5.46$, $df = 0$, $p < 0.0003$).

Cervical Range of Motion

Demiturk., *et al*. [19] found a significant difference in active cervical ROM for subjects in both the CTM and mobilization groups immediately after the intervention and at a one-month follow up, but there was no difference between groups. Donkin., *et al*. [24] also found no intergroup differences in cervical ROM between manipulation and manipulation plus traction groups. The only intragroup change that was significant was an increase in right lateral flexion for the manipulation only group ($p < 0.005$).

Espí-Lopez and Gomez-Conesa [20] found subjects in the SI group had significant improvements in cervical flexion, extension, and bilateral rotation, and the effects for flexion and left rotation were maintained at follow up ($p < .02$ for all). The manipulation group experienced increased cervical extension, left lateral flexion, and bilateral rotation ($p <.03$ for all). Improvements in lateral flexion and rotation remained significant at follow up. The combination group only had increased bilateral ROM ($p < .04$), which was not maintained at follow up. The control group had improvements in cervical flexion ($p < .02$), which remained significant at follow up. These results suggest that both treatments separately may be more favorable for improving ROM than a combination of the two.

Espí-Lopez., *et al*. [21] investigated the effects of manipulation plus massage or massage only on 102 patients with TTH. Subjects received four treatments over four weeks and were assessed at baseline post-intervention, and four weeks after the intervention. Both groups demonstrated a large within-subjects effect for upper cervical flexion ($f = 1.00$), cervical flexion ($f = .27$), a large within-subject effect for upper cervical extension ($f = .62$), and medium effect for cervical extension ($f = .39$). Both groups had significant differences from pre-test to both post-test and follow up scores for upper cervical and cervical extension for both groups ($p < 0.001$), though there was no difference between post-test and follow up scores. Similarly, both groups had significant pre-post and pre-follow up scores for upper cervical and cervical flexion ($p < 0.001$), and there were non-significant differences between post-test and follow up scores. The manipulation and massage group was more effective for improving upper cervical flexion, and this difference remained at follow up.

Frequency and Duration

Bove and Nilsson [18] examined the number of headache hours per day, as recorded in headache diaries. They found no difference between groups, but following the intervention both groups had significant reductions (95% CI, -2.4 to -0.6). The manipulation plus massage group reported a reduction from 2.8 to 1.5 hours and the massage plus sham laser intervention reported a reduction from 3.4 to 1.9 hours.

Donkin., *et al*. [24] also used headache diaries to measure headache frequency and duration. The manipulation only group experienced decreased frequency ($p = 0.0015$) and duration ($p = 0.0098$), but the manipulation plus traction group did not report significant decreases. This suggests the combination of these two treatments may be less effective than manipulation alone.

Espí-Lopez and Gomez-Conesa [20] found their combined treatment of OAA manipulation and suboccipital inhibition to be effective for reducing frequency ($p = 0.000$), which remained significant at follow up ($p = 0.02$). The manipulation only group had a significant decrease ($p < 0.008$), but this was not maintained. There was no decrease for suboccipital inhibition alone.

Espí-Lopez., *et al*. [21] found that subjects who received OAA manipulation had significantly greater reduction in headache frequency ($p < 0.05$) at post-test and at follow-up compared to those who received massage only. There was a medium-sized effect for this difference ($f = .33$).

Other Variables

Donkin., *et al*. [24] assessed neck disability and found values decreased for both the manipulation plus traction group ($p = 0.0033$) and the manipulation only group ($p = 0.0388$), although there was no difference between groups. Espí-Lopez., *et al*. [21] also assessed disability and found that both manipulation plus massage and massage only had large improvements ($f = 1.22$) in Headache Disability Inventory scores.

Bove and Nilsson [18] included analgesic use as an outcome measure. There were no differences at any follow ups between groups, although post-intervention, both groups reported reduced numbers of analgesics used per day (95% CI, -0.5 to -0.1). The manipulation plus massage group decreased from 0.66 to 0.38, and the massage plus sham laser treatment decreased from 0.82 to 0.59.

Hoyt., *et al*. [23] included the variables of EMG of the frontalis muscle and temperature of the dominant hand in their study to investigate any changes that might be present following osteopathic manipulation. There were differences among groups for either of these measures. This finding suggests that subjective ratings of pain severity are not associated with changes in these variables.

Quality of Life was only assessed by one study [21]. Espí-Lopez., *et al*. [22] used the Short Form 12 Health Questionnaire to assess subjects with either chronic or episodic TTH who received SI pressure, SM, a combination of the two interventions, or no treatment. There were no overall improvements immediately post-intervention, but the SI group demonstrated significant overall improvements at follow up ($p = 0.02$). However, there were improvements in specific dimensions of the SF-12 Questionnaire for all groups. All treatment groups improved in physical role, pain interference, and social functioning ($p < 0.05$ for all). Aspects of the emotional role dimension improved for the SI, SM, and combined group; and mental health dimensions improved for the SM and combined groups.

Discussion

The comparison interventions varied in frequency and duration, but most included some form of soft tissue MT. Among studies that assessed pain and intensity, there appeared to be few meaningful differences between groups. One study found no improvement in pain [18], one found manipulation was more effective than a palpation technique [23], and two studies found improvement in all groups, though manipulation only had more favorable results than combined treatments [20,24].

Cervical ROM findings varied between studies. One study found that both group improved, but there was no difference between them [19]. Donkin., *et al*. [24] found no difference between groups, but a small intragroup difference for the manipulation only group. Similarly, Espí-Lopez., *et al*. [21] found both groups improved, but manipulation resulted in greater ROM improvement. Espí-Lopez and Gomez-Conesa [20] found interventions applied separately were more beneficial than combined.

For outcomes of frequency and duration, Bove., *et al*. [18] found improvements for both groups without any intergroup differences. Another found that manipulation alone was more effective than combining it with traction [24]. Espí Lopez., *et al*. [20,21] both concluded the addition of manipulation was more beneficial than soft tissue MT alone. For the outcomes of disability, analgesic use, and quality of life, all interventions resulted in improvements, without any clinically meaningful difference between groups.

The findings of these studies do not strongly suggest the superiority of one MT technique over another. Furthermore, there is little agreement about whether combining MT interventions is more or less effective than performing them independently. This suggests that there are benefits to receiving MT that may be common to the interventions included in this review. Thus, clinicians have some freedom to perform the skilled manual interventions that each patient prefers. It should be noted that in clinical practice, MT is combined with exercise, modalities, and other interventions. However, considering the possible effects of these combinations is beyond the scope of this review.

There is a lack of high quality trials in the literature on the effects of manual therapy and TTH. It would be useful for future studies to compare the effects of MT interventions on individuals with CTTH to those with ETTH, since interventions may affect the two patient populations differently.

Limitations

Almost all studies in this review included both episodic and chronic TTH together, and there may be underlying differences in the etiology and presentation that could indicate a need for different methods of managing the two types. Additionally, most of the included studies were of low quality. Finally, there may be benefits of receiving hands-on treatment that are conferred to multiple MT techniques, thus making it difficult to ascertain the superiority of one intervention over another.

Conflict of Interest

Not applicable.

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Volume 10 Issue 3 March 2018