

# Effectiveness of Neck Myofascial Release Techniques and Exercise Therapy on Pain Intensity and Disability in Patients with Chronic Tension-Type Headache

Mohammad Hosseinifar<sup>1</sup>, Raziieh Bazghandi<sup>2</sup>, Zahra Azimi<sup>2</sup> & Bahareh Khodadadi Bohlouli<sup>2</sup>

<sup>1</sup> Health Promotion Research Center, Zahedan University of Medical Sciences, Zahedan, Iran

<sup>2</sup> School of Rehabilitation Sciences, Zahedan University of Medical Sciences, Zahedan, Iran

Correspondence: Bahareh Khodadadi Bohlouli, School of Rehabilitation Sciences, Zahedan University of Medical Sciences, Dr. Hesabi Sq, Zahedan 98167-43175, Iran. Tel & Fax: 98-541-342-4675. E-mail: Bahareh\_khodadadi@yahoo.com

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## Abstract

**Purpose:** Tension type headache (TTH) is one of the most prevalent types of headache. TTH is classified as episodic if it occurs on less than 15 days a month and as chronic if it occurs more often. Tension, anxiety and depression are some etiological factors for TTH which leads to work efficiency reduction. Today the interest in non-pharmacological methods is increasing; massage is one of these approaches which has no side effects. Aim of this study was to investigate the effects of neck Myofascial Release (MFR) techniques and exercise therapy on pain intensity and disability in patients with chronic tension-type headache.

**Methods:** This randomized clinical trial study was investigated on 30 females suffering from TTH. Participants were randomly assigned into two equal groups (n=15). The MFR group received neck MFR massage and exercise therapy four times a week for 3 weeks, each session lasting 45 minutes. Control group had no intervention. Outcomes were headache intensity and disability measured by numerical rating scale (NRS) and headache disability index (HDI), respectively. Data was analysed through independent and pair t-test.

**Results:** Between group comparison showed significant improvement of headache intensity and disability rate in MFR group ( $p < 0.05$ ) than control group ( $p = 0.000$ ).

**Discussion:** This study provides evidences that MFR technique and exercise therapy have significant effect on patients with TTH.

**Keywords:** tension type headache, myofascial release technique, exercise therapy

## 1. Introduction

Headache is one of the most common problems among people which causes reduction of work efficiency (Cristofolini, Dalla Serra, Scherillo, Orrico, & Micciolo, 2007). International Headache Society classified headache into 14 groups; one of them known as tension type headache (TTH) (Society, 2013). TTH is the most prevalent type of headaches (Bendtsen, 2009; Silver, 2006; Trkanjec & Aleksić-Shihabi, 2008) that imposes huge costs to society (Bendtsen, 2009). Around 42% of adults are suffering from TTH (Ferrante et al., 2015). The pain is bilateral, band like sensation and non-pulsing quality (Trkanjec & Aleksić-Shihabi, 2008). Lower frequency of activation was observed in contraction of temporalis and frontalis muscles in TTH patients which indicates the substantial role of these musculatures in TTH (Figure1) (Biyouki, Laimi, Rahati, Boostani, & Shoeibi, 2015). The patients report functional disturbance, sleep disorder and reduction in routine physical activity (R. F. Castien, Van Der Windt, Dekker, Mutsaers, & Grooten, 2009). The exact mechanism of this headache is unknown, but some authors revealed that isometric contraction of head and neck muscles is an important etiological factor (Quinn, Chandler, & Moraska, 2002). The main reason of this contraction is lack of nutrition which is called as ischemia (Quinn et al., 2002). Fernandez et al. reported greater headache parameters such as intensity, frequency, and duration in TTH patients with trigger points (TPs) rather than others (Fernández - de - las - Peñas, Alonso - Blanco, Cuadrado, Gerwin, & Pareja, 2006). Depression and anxiety, other etiological factors in headache, are different types of body responses to tension that sometimes lead to functional impairment (Loder & Rizzoli, 2008).

Around 20% of TTH patients are looking for pharmacological treatments rather than non-pharmacological approaches for their disease (R. F. Castien et al., 2009). Pharmacological approaches include analgesic, antianxiety and antidepressant drugs (Trkanjec & Aleksic-Shihabi, 2008). Consumption of Amitriptyline is the most frequent method in headache prevention (Bendtsen, 2009). Nowadays, usage of botulinum toxic is customary in treatment and prevention of headache (Trkanjec & Aleksic-Shihabi, 2008). A systematic review conducted by Silver investigated the effect of pharmacological and non-pharmacological approaches in chronic TTH (Silver, 2006). The results showed the effectiveness and safety of some interventions, such as dry needling, head massage and relaxation as alternative treatments (Silver, 2006). Although there is no scientific evidence to support the efficacy of non-pharmacological approaches such as behavior therapy and psychoanalysis, but they are extensively used in these patients (Bendtsen, 2009). Three methods of psychotherapy are supported by evidence: relaxation, biofeedback and cognitive therapy (Álvarez-Melcón, Valero-Alcaide, Atín-Arratibel, Melcón-Álvarez, & Beneit-Montesinos, 2016; Bendtsen, 2009). Physical therapy, as an important part of non-pharmacological treatments, consists of postural correction, exercise therapy, relaxation, massage, dry needling, hot pack, ice pack, ultrasound and electrical stimulation (Bendtsen, 2009; Trkanjec & Aleksic-Shihabi, 2008). Most of these approaches have not been properly evaluated (Bendtsen, 2009; Trkanjec & Aleksic-Shihabi, 2008). Manual therapies, like spinal massage, are considered as a sufficient alternative treatment (A. Moraska & Chandler, 2008).

One of the best treatment for headache is massage which has no side effects (Tsao, 2007). A critical symptom in headache is neck pain and massage can be beneficial in improvement of pain, cramp and tension (Tsao, 2007). Puustjärvi et al. applied 10 sessions of massage therapy on TTH patients over two weeks. The results showed a significant improvement of neck pain in treatment group (Puustjärvi, Airaksinen, & Pöntinen, 1990). Massage also influences on blood circulation, relief of spasm in tender muscle, and relaxation (Quinn et al., 2002). Regular exercise is helpful in headache rehabilitation for pain reduction in long term (R. Castien, Blankenstein, & DeHertogh, 2015; Hindiyeh, Krusz, & Cowan, 2013). Mongini reported that 6 month performance of head and neck postural exercises led to overall reduction of headache frequency and headache days per month (Mongini et al., 2012).

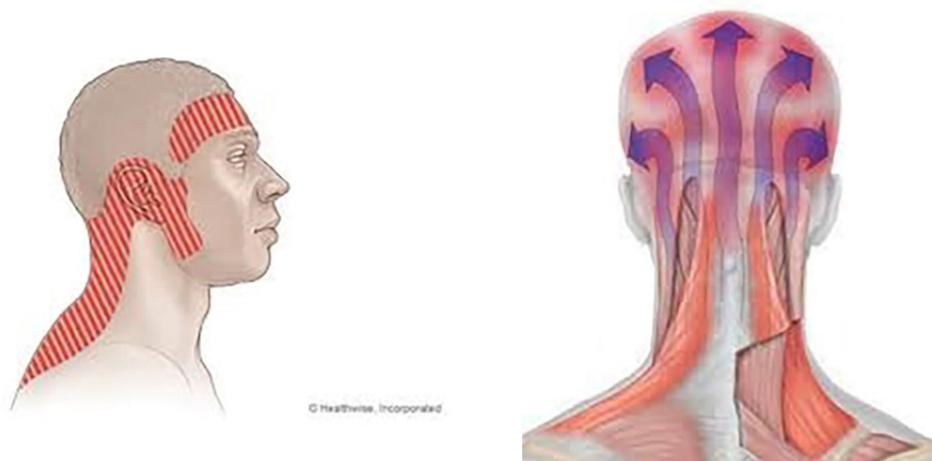


Figure 1. Areas of pain: occipital, temporal and frontal region

According to this fact that millions of people are suffering from TTH around the world and it causes excessive amount of pain and cost, the necessity of this study revealed. Manual therapy is commonly used but its efficacy is under debate in medical society. This study was carried out in order to evaluate the effects of MFR technique and exercise therapy as two non-pharmacological approaches on headache intensity and disability in TTH patients.

## 2. Material and Methods

### 2.1 Study Design

In this randomized clinical trial study, 30 females with TTH were selected through simple non-probability sampling method. Cases were assigned into two equal groups (n=15). The treatment group received MFR technique and exercise therapy 4 times a week for 3 weeks, each session last 45 minutes. Control group had no intervention. The sample size was calculated based on pilot study. Subjects were randomly divided into two equal groups (n=15) by lottery conducted by clinical therapist. According to the method of this study, practitioner and

patients could not be blinded.

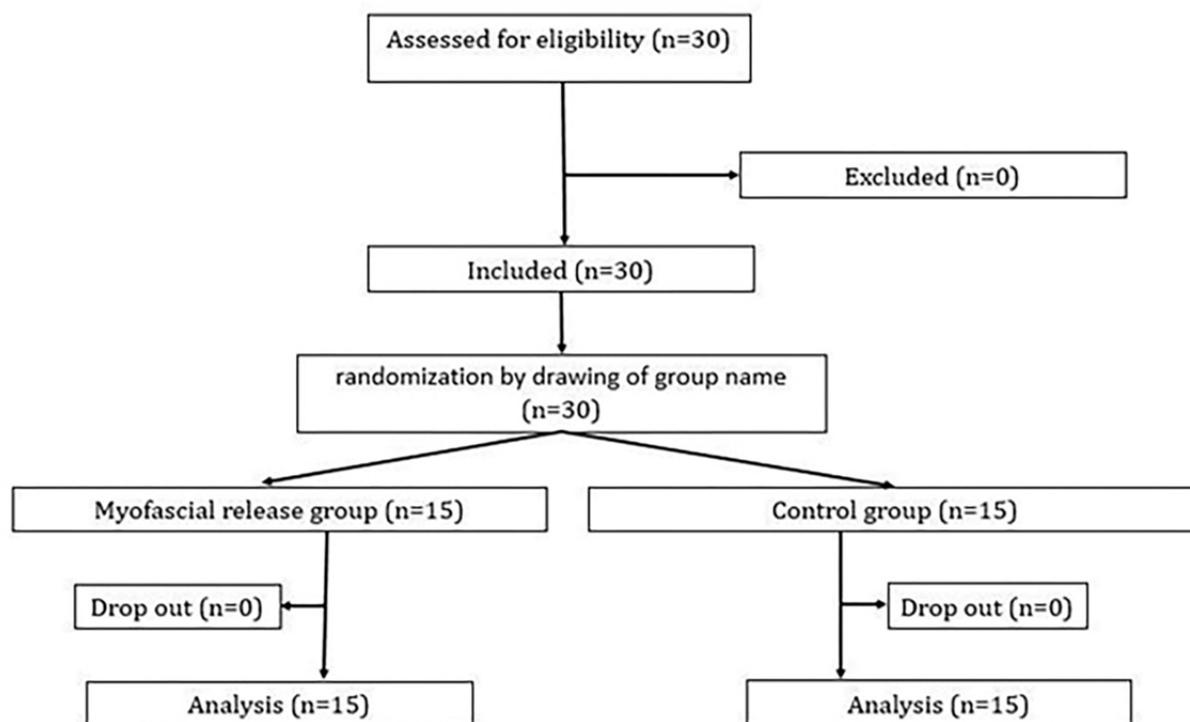


Figure 2. Flow diagram of participant through the trial

## 2.2 Subjects

Participants were female aged 18–55 with diagnosis of chronic TTH. The inclusion criteria for this study were: history of chronic TTH which lasting at least 4 hours for more than 3 month ( $\geq 90$  days in a year) that cause physical disability and dysfunction, pain severity mild to moderate (does not aggravate by routine activities like walking), no sign of vomit, photophobia, phono phobia, taking no antianxiety or antidepressant medicine, not being involved in any manual therapy previous two month, no history of recent fracture, neurological, and sever spinal disorder in cervical spine (i.e. rheumatoid, inflammatory or peripheral nerve disease or disk bulging), malignancy, pregnancy and psychological disorder (R. F. Castien et al., 2009; A. Moraska & Chandler, 2008; Trkanjec & Aleksić-Shihabi, 2008). The exclusion criteria included: having another treatment method or trauma during study, not completing all the interventional sessions, and pain increment because of the intervention.

## 2.3 Measurements

The patients were asked to fill out a questionnaire, one week pre and post intervention, contained two variables: 1) pain intensity assessed by numerical rating scale (NRS) which is used in adults and children above 9 years old (MacCaffery & Beebe, 1989). According to this scale, zero point is “no pain”, 1-3 point is “mild pain” which means pain has no disturbance in daily life, 4-6 is “moderate pain” which means huge disturbance of pain in daily life, and 7-10 is “severe pain” leads to disability. 2) Effects of headache on daily life assessed by Headache Disability Index (HDI) which contain 25 questions about physical and mental function (R. F. Castien et al., 2009; A. Moraska & Chandler, 2008). It has three kinds of answer; No (0 point), Sometimes (2 point), Yes (4 point). By adding each number score, total score achieved as a number between 0 (no disability) and 100 (severe disability). More than 16 points decreasing in disability index supposed as significant improvement.

## 2.4 Intervention

### 2.4.1 MFR Technique

Two methods of neck MFR technique were exerted in this study: 1) Patient was instructed to lie at supine position with hands on abdomen and legs externally rotated for relaxation. Practitioner sat at the top of the bed at the end of cephalad side and placed her forearms on bed, wrists in neutral position, metatarsophalangeal joints flexed 90

degree, and interphalangeal joints in extension. Practitioner's hands were placed under patients' head while tip of fingers were in sub occipital notch in contact with neck muscles. Patients' head should be relaxed while longitudinal stretches had been applying by forearm. When occiput bone completely placed on therapist hands stretches had been stopped. 2) Patient and practitioner were placed at the same position in the previous method. Practitioner cupped the palm and put it under patient's occiput so that thumbs were placed over ears and the fingers were on the neck muscle. Therapist applied longitudinal stretch with constant pressure and hold it until a sensation of softening has been felt.

#### 2.4.2 Exercise Therapy

Two kinds of exercises were investigated in this study (Kisner & Colby, 2012): 1) Cranio cervical flexion: patients were instructed to move the chin toward chest without cervical movement. 2) Cervical retraction: patients were asked to perform backward head extension in straight line.

#### 2.5 Statistical Analysis

For statistical analysis we used SPSS version 15. Comparison between and within groups performed by independent and paired t-test. P-value less than 0.05 considered as significant level in all tests.

This study was approved by the Scientific and Ethics Committee of the School of Rehabilitation Sciences of Zahedan University of Medical Sciences.

### 3. Result

None of the participants were excluded. The mean age of subjects in treatment group were  $25.06 \pm 7.64$  and in control group were  $29.33 \pm 11.63$ . The mean and standard deviation of demographic data and results of HDI and NRS before and after treatment are presented in Table 1 and Table 2, respectively.

Table 1. Baseline characteristics of study participants (n=30)

Characteristic	MFR group (n=15)	Control group (n=15)
Age (year)	$25.06 \pm 7.64$ *	$29.33 \pm 11.63$
Height (cm)	$161.06 \pm 5.35$	$161.13 \pm 5.59$
Weight (Kg)	$56.93 \pm 6.35$	$60.46 \pm 5.11$

\* Data are expressed as mean $\pm$ SD.

The results in the Table 1 revealed that in MFR group numerical rating scale (NRS) and headache disability index (HDI) have improved significantly ( $p < 0.05$ ), but no changes were observed in control group. Between two groups comparison induced no statistically significant difference in NRS and HDI before treatment. Therefore, both groups had the same condition (NRS ( $p=1$ ) and HDI ( $p=0.52$ )). After the intervention, results showed a significant difference between two groups ( $p=0.000$ ).

Table 2. Results of NRS and HDI pre and post intervention for experimental and control group

Outcome measurement	MFR group			Control group			Result comparison after treatment
	Before treatment	After treatment	P value	Before treatment	After treatment	P value	
Pain intensity	$4.06 \pm 0.69$ *	$2.33 \pm 1.11$	0.000**	$4.06 \pm 1.27$	$4.06 \pm 1.16$	1.000	0.000
Disability rate	$32.93 \pm 14.98$	$10.53 \pm 7.61$	0.000	$37.33 \pm 22.17$	$36.13 \pm 23.18$	0.219	0.000

\*Data are expressed as mean $\pm$ SD;

\*\* P value  $\leq 0.05$  considered as significant level.

#### 4. Discussion

The principle finding of this study is that MFR technique combined with exercise therapy was significantly effective in treatment of TTH patients vs. control group. The intervention, consist of 12 session of MFR and exercise therapy leads to improvement of disability rate and reduction of headache intensity in patients.

There are several etiological factors for TTH; chronic low-level involuntary contraction of pericranial muscles has been speculated to be an important source of pain in TTH sufferers (Biyouki et al., 2015). Muscle tenderness and psychological tension are associated with tension-type headache and aggravate it (Ashina, 2004). Harden mentioned that myofascial trigger points (MTPs) are associated with motor endplate abnormalities and increased release of acetylcholine, becoming areas of focal spasm and ischemia which its long term effect is nociceptive sensitization and chronic pain that can lead to chronic TTH (Harden et al., 2009). It means that continues contraction of pericranial muscle result in tenderness of this musculature and formation of MTPs in long term. This procedure finally leads to sensitization; chronic pain and TTH (Davidoff, 1998) which level of this sensitization can be measured by pressure pain (R. Castien et al., 2015).

Several studies are conducted on effectiveness of manual therapy on TTH most of them focused on trigger point's treatment. In a study investigated by Doraisamy, single session of ischemic compression and stretch were applied on trigger points that lead to reduction of headache intensity and frequency as a short term effect (Doraisamy, Kumar, & Gnanamuthu, 2010). However Moraska regulated a study consist of 12 sessions of different types of manual therapy and massage in 5 stages to evaluate the long term effects of TPs releasing in TTH (A. Moraska & Chandler, 2008). Present study executed MFR as an indirect technique on TPs to evaluate the efficacy of this approach in eradicating of muscle spasm followed by TPs releasing. However in a recent study conducted by Moraska the effect of placebo treatment was specified. In this study trigger points release group and placebo group indicated reduction of headache frequency than control group. It seems that the one important part of massage group improvement is related to contextual factor not only release of trigger points. Thereby it is recommended to future studies to include a placebo group in their trail to estimate the specific contribution of active intervention (A. F. Moraska et al., 2015).

An important aspect of treatment which can affects final results is the type of MFR technique that has been exerted. MFR includes various techniques that can be applied on different segments. Different types of techniques and target segments, lead to variant results. Ferragut-Garcías executed manual therapy on Sternocleidomastoid muscle, Temporal muscle, Suboccipital musculature, Masseter muscle and Upper trapezius muscle to release them in combination of neural mobilization which has induced significant changes in pressure pain threshold and impact of daily life activity (Ferragut-Garcías et al., 2016). Quinn et al. benefited from a massage therapy protocol in their study. This protocol included warm up, MFR, traction, treat of TPs, stretch, and finally effleurage and petrissage strokes (Quinn et al., 2002). The main part of MFR technique was focused on deltoid, pectoral and upper trapezius muscle (Quinn et al., 2002). The results indicated significant reduction of headache frequency and duration but because of extremely small sample size, their results cannot be generalized (Quinn et al., 2002). Ajimsha compared direct vs. indirect MFR technique in TTH sufferers (Ajimsha, 2011). Direct approach contains release of fascia surrounding the neck, trapezius muscle and deep neck flexor muscle. Indirect approach contains stretch of face and cervical musculature and pulling of head and ears. Control group received slow soft stroke. Results showed that both MFR techniques were more effective than control intervention, but there was no significant difference between two MFR approaches. Main cause of this contradiction is because of different amount of pressure and duration which were investigated in two approaches. In compare with these studies, present article concentrated on releasing of suboccipital musculature as an important source of pain in headaches.

One study has been reported no effectiveness of head and neck massage on pain intensity in TTH (Quinn et al., 2002). This contradictory might happen because of difference in massage duration, measurements tool for pain intensity, and this fact that pain perception is a subjective phenomenon that is various among people.

According to Toro-Velasco, manual therapy in TTH patients leads to increment of heartbeat and reduction of tension, pressure pain sense and violent in patients (Toro-Velasco, Arroyo-Morales, Fernández-de-las-Peñas, Cleland, & Barrero-Hernández, 2009). Massage therapy techniques may reduce the activity of a trigger point. Thus, it is possible that headaches originating from this etiology be reduced by the mean of massage therapy (Quinn et al., 2002). Massage could also release the spasm and improve ischemia. Therefore, as chronic pain disappears the TTH can be treated. The method of present study is based on the results of previous papers which claimed that manual therapy combined with another technique is more effective than manual therapy alone (Espí-López, Arnal-Gómez, Arbós-Berenguer, González, & Vicente-Herrero, 2014; Ferragut-Garcías et al., 2016). Espí-López mentioned in her literature review article that manual therapy combined with cervical muscle stretching is more effective than

operating each technique alone (Espí-López et al., 2014).

Another key point of treatments in this trial was exercise therapy which was included two types of stabilization exercise in order to strengthening of deep neck flexor muscles. Several studies investigated the effectiveness of exercise therapy in improvement of headache symptoms which postural exercise and relaxation had the most efficacy (Hindiyeh et al., 2013). In a study Lluch et al. compared active exercises of the upper cervical spine to passive exercises in combination with mobilization of the upper cervical spine (Lluch et al., 2014). A greater reduction in cervical pressure pain was measured in the active exercise group in chronic neck pain patients (Lluch et al., 2014). Castien studied on the effects of isometric exercise and mobilization on pressure pain sense (R. Castien et al., 2015). Hindiyeh study revealed the effectiveness of postural exercise on reduction of intensity and frequency of headache (Hindiyeh et al., 2013). In present study stabilization exercise were selected for strengthening of deep neck flexor muscle among different types of exercise according to previous studies. An article arranged by Dusunceli demonstrated the superiority of neck stabilization exercise in comparison with isometric and stretching exercise in reduction of pain and disability in neck pain patients (Dusunceli, Ozturk, Atamaz, Hepguler, & Durmaz, 2009). Jull et al. showed the effectiveness of stabilization exercise in reduction of neck pain and improvement of muscle performance in cervicogenic headache sufferers (Jull et al., 2002).

Inclusively, training of deep neck flexor muscles can release the tendered extensor muscles with reciprocal inhibition and result in stretching of suboccipital muscle (Hallgren, 2014). Finally it leads to reduction of pressure pain sense and sensitization. This procedure may contribute to the pathophysiological models of chronic TTH in which cervical afferent inputs play an important role (R. Castien et al., 2015).

This question may be raised as which the more effective component of treatment protocol is investigated in present study. Many studies were benefited from diverse treatment protocol to cover various aspects of deficits in any disorder like TTH; for instant, the combination of stabilization exercise with physical therapy agents (Dusunceli et al., 2009). Clenay indicated in his study that stabilization exercise with manual therapy is superior to stabilization exercise alone (Celenay, Akbayrak, & Kaya, 2016). According to this findings, a treatment protocol consist of manual and exercise therapy was investigated in this study in order to release the MTPs and hypertension muscle by MFR, inhibit the tender suboccipital musculature by training of flexor muscles and finally prevent the relapse and remission cycle by strengthening of deep neck flexor muscle.

## 5. Conclusion

As claimed by results of this study, MFR technique in combination with exercise therapy of cervical muscle can be recommended as an effective approach in TTH treatment. It is a simple, inexpensive and executable approach which can be used by any skilled clinician as an independent treatment method or complementary methods to reduce the amount of drug consumption and its side effects.

## 6. Limitations

There were some limitations in this study. The first one was absence of long term follow up (at least 3 months) of patients for evaluation of long term effects of treatment. Second one was lack of blinding of practitioner and participants because of the applied method in previous study.

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## Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

## References

- Ajimsha, M. (2011). Effectiveness of direct vs indirect technique myofascial release in the management of tension-type headache. *Journal of bodywork and movement therapies*, 15(4), 431-435. <http://dx.doi.org/10.1016/j.jbmt.2011.01.021>
- Álvarez-Melcón, A., Valero-Alcaide, R., Atín-Arratibel, M., Melcón-Álvarez, A., & Beneit-Montesinos, J. (2016). Effects of physical therapy and relaxation techniques on the parameters of pain in university students with tension-type headache: A randomised controlled clinical trial. *Neurologia (Barcelona, Spain)*.
- Ashina, M. (2004). Neurobiology of chronic tension-type headache. *Cephalalgia*, 24(3), 161-172. <http://dx.doi.org/10.1111/j.1468-2982.2003.00644.x>
- Bendtsen, L. (2009). Review: Drug and nondrug treatment in tension-type headache. *Therapeutic advances in*

- neurological disorders*, 2(3), 155-161. <http://dx.doi.org/10.1177/1756285609102328>
- Biyouki, F., Laimi, K., Rahati, S., Boostani, R., & Shoeibi, A. (2015). Morphology of muscular function in chronic tension-type headache: a pilot study. *Acta Neurologica Belgica*, 1-8.
- Castien, R., Blankenstein, A., & DeHertogh, W. (2015). Pressure Pain and Isometric Strength of Neck Flexors Are Related in Chronic Tension-Type Headache. *Pain physician*, 18, E201-E205.
- Castien, R. F., Van Der Windt, D. A., Dekker, J., Mutsaers, B., & Grooten, A. (2009). Effectiveness of manual therapy compared to usual care by the general practitioner for chronic tension-type headache: design of a randomised clinical trial. *BMC Musculoskeletal Disorders*, 10(1), 1. <http://dx.doi.org/10.1186/1471-2474-10-21>
- Celenay, S. T., Akbayrak, T., & Kaya, D. O. (2016). A Comparison of the Effects of Stabilization Exercises Plus Manual Therapy to Stabilization Exercises Alone in Patients With Nonspecific Mechanic Neck Pain: A Randomized Clinical Trial. *Journal of Orthopaedic & Sports Physical Therapy*(0), 1-37.
- Cristofolini, A., Dalla Serra, P., Scherillo, G., Orrico, D., & Micciolo, R. (2007). The prevalence of headache in a population of health care workers and the effects on productivity costs. *La Medicina del lavoro*, 99(1), 8-15.
- Davidoff, R. (1998). Trigger points and myofascial pain: toward understanding how they affect headaches. *Cephalalgia*, 18(7), 436-448. <http://dx.doi.org/10.1046/j.1468-2982.1998.1807436.x>
- Doraisamy, M. A., Kumar, C. P., & Gnanamuthu, C. (2010). Chronic tension type headache and the impact of myofascial trigger point release in the short term relief of headache. *Global Journal of Health Science*, 2(2), 238. <http://dx.doi.org/10.5539/gjhs.v2n2p238>
- Dusunceli, Y., Ozturk, C., Atamaz, F., Hepguler, S., & Durmaz, B. (2009). Efficacy of neck stabilization exercises for neck pain: a randomized controlled study. *Journal of rehabilitation medicine*, 41(8), 626-631. <http://dx.doi.org/10.2340/16501977-0392>
- Espí-López, G. V., Arnal-Gómez, A., Arbós-Berenguer, T., González, Á. A. L., & Vicente-Herrero, T. (2014). Effectiveness of physical therapy in patients with tension-type headache: literature review. *Journal of the Japanese Physical Therapy Association*, 17(1), 31. [http://dx.doi.org/10.1298/jjpta.Vol17\\_005](http://dx.doi.org/10.1298/jjpta.Vol17_005)
- Fernández - de - las - Peñas, C., Alonso - Blanco, C., Cuadrado, M. L., Gerwin, R. D., & Pareja, J. A. (2006). Myofascial Trigger Points and Their Relationship to Headache Clinical Parameters in Chronic Tension-Type Headache. *Headache: The Journal of Head and Face Pain*, 46(8), 1264-1272. <http://dx.doi.org/10.1111/j.1526-4610.2006.00440.x>
- Ferragut-Garcías, A., Plaza-Manzano, G., Rodríguez-Blanco, C., Velasco-Roldán, O., Pecos-Martín, D., Oliva-Pascual-Vaca, J., . . . Kern, C. (2016). Effectiveness of a Treatment Involving Soft Tissue Techniques and/or Neural Mobilization Techniques in the Management of the Tension-Type Headache: A Randomized Controlled Trial. *Archives of Physical Medicine and Rehabilitation*. <http://dx.doi.org/10.1016/j.apmr.2016.08.466>
- Ferrante, T., Manzoni, G., Russo, M., Taga, A., Camarda, C., Veronesi, L., . . . Torelli, P. (2015). The PACE study: past-year prevalence of tension-type headache and its subtypes in Parma's adult general population. *Neurological Sciences*, 36(1), 35-42. <http://dx.doi.org/10.1007/s10072-014-1888-0>
- Hallgren, R. C. (2014). Modeling length-tension properties of RCPm muscles during voluntary retraction of the head. *Manual therapy*, 19(4), 319-323. <http://dx.doi.org/10.1016/j.math.2014.03.007>
- Harden, R. N., Cottrill, J., Gagnon, C. M., Smitherman, T. A., Weinland, S. R., Tann, B., . . . Houle, T. T. (2009). Botulinum Toxin A in the Treatment of Chronic Tension - Type Headache With Cervical Myofascial Trigger Points: A Randomized, Double-Blind, Placebo-Controlled Pilot Study. *Headache: The Journal of Head and Face Pain*, 49(5), 732-743. <http://dx.doi.org/10.1111/j.1526-4610.2008.01286.x>
- Hindiyeh, N. A., Krusz, J. C., & Cowan, R. P. (2013). Does exercise make migraines worse and tension type headaches better? *Current pain and headache reports*, 17(12), 1-10. <http://dx.doi.org/10.1007/s11916-013-0380-5>
- Jull, G., Trott, P., Potter, H., Zito, G., Niere, K., Shirley, D., . . . Richardson, C. (2002). A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. *Spine*, 27(17), 1835-1843. <http://dx.doi.org/10.1097/00007632-200209010-00004>
- Kisner, C., & Colby, L. A. (2012). *Therapeutic exercise: foundations and techniques*: Fa Davis.

- Lluch, E., Schomacher, J., Gizzi, L., Petzke, F., Seegar, D., & Falla, D. (2014). Immediate effects of active cranio-cervical flexion exercise versus passive mobilisation of the upper cervical spine on pain and performance on the cranio-cervical flexion test. *Manual therapy*, 19(1), 25-31. <http://dx.doi.org/10.1016/j.math.2013.05.011>
- Loder, E., & Rizzoli, P. (2008). Tension-type headache. *BMJ*, 336(7635), 88. <http://dx.doi.org/10.1136/bmj.39412.705868.AD>
- MacCaffery, M., & Beebe, A. (1989). *Pain: Clinical manual for nursing practice*: Mosby.
- Mongini, F., Evangelista, A., Milani, C., Ferrero, L., Ciccone, G., Ugolini, A., . . . Banzatti, E. (2012). An educational and physical program to reduce headache, neck/shoulder pain in a working community: a cluster-randomized controlled trial. *PloS one*, 7(1), e29637. <http://dx.doi.org/10.1371/journal.pone.0029637>
- Moraska, A., & Chandler, C. (2008). Changes in clinical parameters in patients with tension-type headache following massage therapy: a pilot study. *Journal of Manual & Manipulative Therapy*, 16(2), 106-112. <http://dx.doi.org/10.1179/106698108790818468>
- Moraska, A. F., Stenerson, L., Butryn, N., Krutsch, J. P., Schmiede, S. J., & Mann, J. D. (2015). Myofascial trigger point-focused head and neck massage for recurrent tension-type headache: A randomized, placebo-controlled clinical trial. *The Clinical journal of pain*, 31(2), 159. <http://dx.doi.org/10.1097/AJP.0000000000000091>
- Puustjärvi, K., Airaksinen, O., & Pöntinen, P. J. (1990). The effects of massage in patients with chronic tension headache. *Acupuncture & electro-therapeutics research*, 15(2), 159-162. <http://dx.doi.org/10.3727/036012990816358234>
- Quinn, C., Chandler, C., & Moraska, A. (2002). Massage therapy and frequency of chronic tension headaches. *American journal of public health*, 92(10), 1657-1661. <http://dx.doi.org/10.2105/AJPH.92.10.1657>
- Silver, N. (2006). Headache (chronic tension-type). *Clinical Evidence*, 2007.
- Society, H. C. C. O. T. I. H. (2013). The international classification of headache disorders, (beta version). *Cephalalgia*, 33(9), 629-808. <http://dx.doi.org/10.1177/0333102413485658>
- Toro-Velasco, C., Arroyo-Morales, M., Fernández-de-las-Peñas, C., Cleland, J. A., & Barrero-Hernández, F. J. (2009). Short-term effects of manual therapy on heart rate variability, mood state, and pressure pain sensitivity in patients with chronic tension-type headache: a pilot study. *Journal of manipulative and physiological therapeutics*, 32(7), 527-535. <http://dx.doi.org/10.1016/j.jmpt.2009.08.011>
- Trkanjec, Z., & Aleksić-Shihabi, A. (2008). [Tension-type headaches]. *Acta medica Croatica: casopis Hrvatske akademije medicinskih znanosti*, 62(2), 205-210.
- Tsao, J. C. (2007). Effectiveness of massage therapy for chronic, non-malignant pain: A review. *Evidence-based complementary and alternative medicine*, 4(2), 165-179. <http://dx.doi.org/10.1093/ecam/nel109>

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