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MYOFASCIAL PAIN AND TREATMENT: RANDOMIZED CLINICAL TRIAL

Dry needling versus friction massage to treat tension type headache: A randomized clinical trial☆

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ABSTRACT

Tension type headache (TTH), the most common type of headache, is known to be associated with myofascial pain syndrome and the existence of myofascial trigger points. There are several treatment options for myofascial trigger points. In this study we compared the effectiveness of dry needling and friction massage to treat patients with TTH.

A convenience sample of 44 patients with TTH participated in this randomized clinical trial. The frequency and intensity of headache, pressure pain threshold at the trigger point site, and cervical range of motion were recorded. Then the participants were randomly assigned to one of two treatment groups for dry needling or friction massage, delivered in 3 sessions during 1 week. The participants were evaluated 48 h after the last treatment session. Analysis of covariance, paired *t*-test and Wilcoxon's test were used for statistical analysis.

The results showed that both treatment methods significantly reduced headache frequency and intensity, and increased pain threshold at the trigger points. However, neither treatment had any effect on cervical range of motion except for extension, which increased in the dry needling group. Between-group comparisons showed that dry needling increased pain threshold significantly more than friction massage. There were no significant differences between groups in any other outcome variables.

Dry needling and friction massage were equally effective in improving symptoms in patients with TTH. The decreases in frequency and intensity of headache were similar after both dry needing and friction massage.

1. Introduction

Tension type headache (TTH), the most common type of headache, has a lifetime prevalence estimated at 78% (Crystal and Robbins, 2010). Peripheral and central factors such as afferent inputs from myofascial tissue and sensitization of the central nervous system are decisive factors in the pathophysiology of TTH (Jensen, 1999). In patients with TTH, muscular involvement can manifest as tenderness and stiffness of the facial and cranial muscles (Davidoff, 1998). This muscular tenderness is related to the intensity and frequency of TTH (Jensen et al., 1998). The most muscles involved most commonly in TTH include the sub-occipital, temporalis, sternocleidomastoid (SCM), upper trapezius, levator scapula, splenius, and masseter (Fernández-de-las-Peñas et al., 2006b; Melchart et al., 2005). Tension type headache is known to be associated with myofascial pain syndrome and the existence of myofascial trigger points (Ghanbari et al., 2012). Many symptoms of TTH such as pain, stiffness and limitation of motion in the cervical region resemble the presence of trigger points. Therefore, these symptoms of TTH can be attributed to trigger points in the cervical and mastication muscles (Davidoff, 1998).

Trigger points are small, tender points in the muscle or connective tissue that can cause pain attributed to distant sites (Ross, 2004). The synthesis and release of inflammatory substances such as histamine, prostaglandins, bradykinin and serotonin are increased in trigger point sites, and these substances may stimulate

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nociceptors (Davidoff, 1998). It is known that these substances can affect the polymodal nociceptor membrane and sensitize these receptors. Neuronal sensitization, in turn, may decrease the pain threshold and facilitate nociceptor activity. Thus nociceptor sensitization may affect the activity of central neurons and result in central sensitization (Davidoff, 1998). It is this central sensitization which is known to be the underlying mechanism of TTH (Fernández-de-las-Peñas et al., 2007a).

Central sensitization in TTH is due to the continuous input via sensory afferents from the pericranial muscles and myofascial tissues – a phenomenon that can change episodic TTH to chronic headache (Bendtsen, 2000). Accordingly, diminishing afferent inputs by treating trigger points is an important goal for patients with TTH. Cardoso et al. and Moraska et al. showed that treatment of the trigger points was effective in improving symptoms in patients with TTH (Cardoso de Sousa and Lima de Matos, 2014; Moraska et al., 2015).

There are several treatment options for myofascial trigger points (Ross, 2004). For example, previous studies found that dry needling (Hsieh et al., 2007; Ong and Claydon, 2014; Gerber et al., 2015; Rayegani et al., 2014) and massage (Fernández-de-las-Peñas et al., 2006a; Fryer and Hodgson, 2005; Aguilera et al., 2009; Moraska et al., 2015) were effective choices for myofascial pain syndrome. These two methods have also been shown to be effective in the treatment of TTH (Karakurum et al., 2001; Cardoso de Sousa and Lima de Matos, 2014; Moraska et al., 2015); however, the superiority of one approach over the other remains unclear. In this study we compared the effectiveness of dry needling and friction massage to treat patients with TTH who had trigger points in the sub-occipital, temporalis, SCM or upper trapezius muscles.

2. Materials and methods

2.1. Study design

This was a parallel single-blind randomized clinical trial, and was approved by the local ethics committee (IR.SUMS.REC.1395.67).

2.2. Participants

A convenience sample of 44 patients with TTH diagnosed by a neurologist was recruited with a 1:1 allocation ratio. The participants were examined for any trigger points in their sub-occipital, temporalis, SCM and upper trapezius muscles. To the best of our knowledge, these are the muscles involved most frequently in TTH according to most published studies. Referred pain, the presence of a taut band and the jump sign were the criteria for trigger point diagnosis (Davidoff, 1998). Patients with a history of TTH for at least 6 months and who had at least 3 trigger points in the muscles we examined were enrolled in the study after they had completed and signed an informed consent form. Patients with cervical disk herniation, any neurological or rheumatoid disease, and patients who used antidepressant or anti-anxiety medication were excluded from the study, as were women who were pregnant or breast-feeding. After initial examination, they were randomly assigned to one of two intervention groups (dry needling or friction massage) with a random assignment method. Each participant received a random number, and participants with odd or even numbers were allocated to one group or the other. Participants were blind to the study groups, and were unaware of the other study group. One of the patients withdrew from the study after initial examination because of needle phobia. Three patients received treatment but did not attend the final follow-up appointment. In all, data from 40 patients were used in our final analyses.

2.3. Outcome measures

The participants' self-reported frequency and intensity of headaches were recorded during 1 week. The pressure pain threshold at trigger point sites was recorded with an algometer (Wagner, Greenwich, CT, USA). The cervical range of motion in flexion, extension, right and left rotation, and right and left side flexion was recorded with a goniometer. The reliability and validity of these instruments have been determined previously (Kinser et al., 2009; Williams et al., 2010; Youdas et al., 1991). Range of motion was assessed because any changes may indicate improvement in the trigger points.

The frequency of headaches was recorded as the number of days in a week when the patient experienced pain. The intensity of headaches was recorded on a visual analog scale (VAS). To assess the pain threshold, the algometer was placed vertically on the trigger point and pressed onto the body surface until the participant reported feeling pain. At that moment the reading (kg/cm^2) from the algometer screen was recorded. Cervical range of motion was assessed according to Norkin and White, (2009).

2.4. Procedure

After initial examination and data collection, the participants underwent dry needling or friction massage. Dry needling of the involved muscles was done according to Dommerholt & Fernandez-de-las-Penas (2013). In this method, there is a specific position for needling each muscle, and needling is done directly on trigger points. Friction massage was performed with the fingertips placed on the trigger points. Pressure was applied and the fingertips were moved in a circular manner, while the pressure was gradually increased. This massage was applied until the patient report a reduction in pain at the trigger point (Hollis, 2009). All of the trigger points in the muscles we examined were treated in this study. All participants received 3 sessions of treatment during 1 week. Then they were evaluated again 48 h after the last treatment session. This study did not use intention–to-treat analysis.

2.5. Statistical analysis

Sample size was calculated based on a previous study ($\alpha = 0.05$, $\beta = 0.80$) (Ghanbari et al., 2012). The data were analyzed with SPSS v. 22 software. Normality of the data was checked with the Kolmogorov-Smironov test. We used analysis of covariance (ANCOVA) for between-group comparisons. Because of non-normal distribution of data, the paired *t*-test and Wilcoxon test were used for within-group comparisons. The significance level was set at 0.05.

3. Results

The eligibility criteria of the participants are summarized in Fig. 1.

A total of 40 people with TTH (5 men and 35 women) participated in this study. There were no statistically significant differences between groups in mean age (37.45 ± 12.57 vs. 33.70 ± 9.94 years, $P = 0.30$), height (164.35 ± 8.24 vs. 165.15 ± 8.93 cm, $P = 0.77$), weight (72.95 ± 9.65 vs. 70.42 ± 13.00 kg, $P = 0.49$) or gender distribution (4 men and 16 women vs. 1 man and 19 women, $P = 0.15$). The clinical characteristics of the participants before treatment are shown in Table 1. Because pain threshold and right side flexion range of motion were significantly different between the two groups at baseline, we used ANCOVA for between-group comparisons.

The results of the study are shown in Table 2. The frequency and

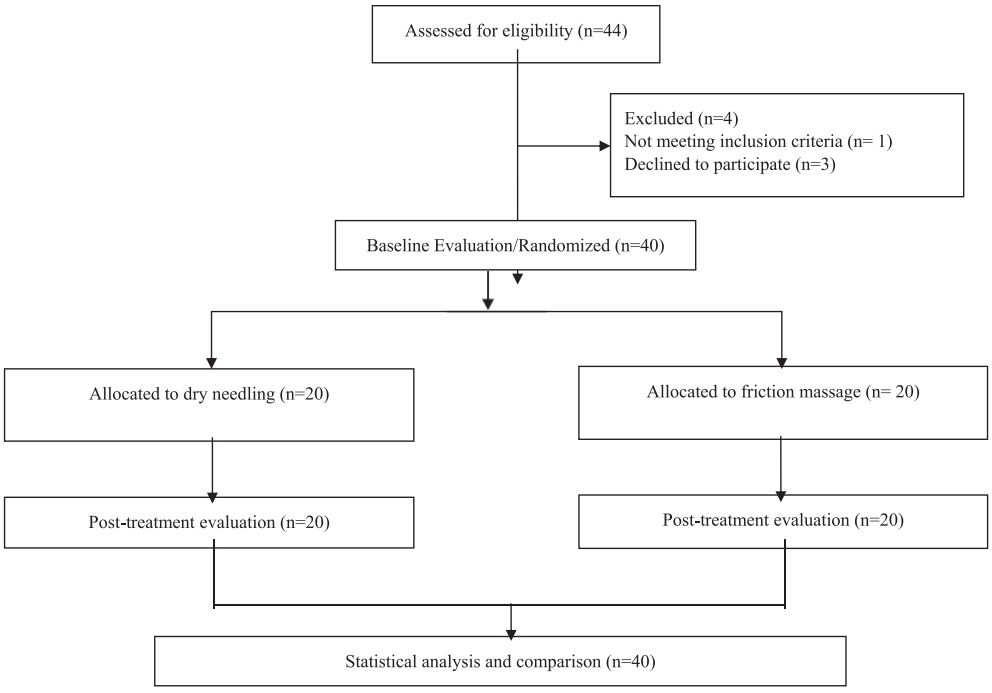

Fig. 1. Flowchart for enrollment and testing procedures.

Table 1
Patients' clinical characteristics at baseline.

Variable		Dry needling (median)	Friction massage (median)	P value
Headache frequency		5.00	7.00	0.14
Headache intensity		8.00	9.50	0.15
Pain threshold		1.07	0.86	0.03[a]
Cervical range of motion	Flexion	36.25	35.00	0.29
	Extension	50.00	45.00	0.71
	Right rotation	60.00	55.50	0.75
	Left rotation	63.75	65.00	0.53
	Right side flexion	30.00	40.00	0.001[a]
	Left side flexion	30.00	41.00	0.75

[a] Indicates significance at $P < 0.05$ (between-group comparison according to the Mann-Whitney test).

Table 2
The effect of dry needling and friction massage on pain and range of motion in patients with tension type headache.

Variable		Dry needling (mean ± SD)	Friction massage (mean ± SD)	P value
Headache frequency		1.95 ± 2.08[b]	2.85 ± 2.56[b]	0.70
Headache intensity		3.00 ± 2.31[b]	4.22 ± 3.51[c]	0.40
Pain threshold		1.27 ± 0.25[b]	1.12 ± 0.42[c]	0.008[a]
Cervical range of motion	Flexion	35.37 ± 6.24	36.75 ± 6.83	0.80
	Extension	55.75 ± 10.51[b]	51.80 ± 14.58	0.08
	Right rotation	59.35 ± 5.41	61.25 ± 10.80	0.055
	Left rotation	61.42 ± 8.74	65.37 ± 9.46	0.15
	Right side flexion	31.87 ± 3.33	37.57 ± 6.76	0.07
	Left side flexion	32.00 ± 4.10	39.60 ± 7.16	0.67

[a] Indicates significance at $P < 0.05$ (between-group comparison according to ANCOVA).
[b] Indicates significance at $P < 0.05$ (within-group comparison according to paired *t*-test).
[c] Indicates significance at $P < 0.05$ (within-groups comparison according to the Wilcoxon test).

intensity of headache, and pain threshold at the trigger points, improved significantly in both study groups. However, neither of the two methods had any effect on cervical range of motion except for extension, which increased in the dry needling group. Between-group comparison showed that dry needling increased the pain threshold significantly more than friction massage. There were no significant between-group differences in any other outcome variables.

4. Discussion

This study compared the effect of dry needling and friction massage on changes in TTH symptoms. Both treatments were applied on myofascial trigger points in the sub-occipital, temporalis, SCM and upper trapezius muscles. The results showed that both methods had similar effects in patients with TTH; however, dry needling increased the pain threshold at trigger points more

than friction massage did.

Dry needling and friction massage are known to be effective treatment choices for myofascial trigger points (Kietrys et al., 2014; Gerber et al., 2015; Moraska et al., 2015). Kietrys et al. in a systematic review, concluded that dry needling is effective in patients with upper quarter pain. However, the impact of this treatment mode in patients with craniofacial pain remains to be determined (Kietrys et al., 2014).

The effectiveness of these two treatments in patients with TTH has been evaluated separately; however, no earlier studies have compared the two approaches. Berggreen et al. investigated the effect of massage on muscles with trigger points, and Ghanbari et al., Cardoso de Sousa and Lima de Matos, and Moraska et al. investigated the effect of myofascial release of trigger points in patients with TTH. They reported that massage and myofascial release at trigger point sites can improve the symptoms in patients with TTH. (Ghanbari et al., 2012; Berggreen et al., 2012; Cardoso de Sousa and Lima de Matos, 2014; Moraska et al., 2015). On the other hand, Karakurum et al. found that dry needling of trigger points can also improve symptoms in patients with TTH (Karakurum et al., 2001). A systematic review by France et al. concluded that despite insufficient evidence, dry needling may be useful in headache management (France et al., 2014).

The mechanism of trigger point pain is not entirely clear. Some research has reported increased levels of pain-related substances in the site of trigger points (Fernández-de-las-Peñas et al., 2006b). Pain-related chemicals can accumulate at these sited due to extreme sarcomere contractions, resulting in localized tissue hypoxia (Windisch et al., 1999). Dry needling or friction massage on trigger points can separate the muscle sarcomeres and consequently reduce ischemia and increase blood flow to the area. The increased blood flow, in turn, facilitates leaching of these substances and thus tissue repair (Simons, 1996). The higher pain threshold after dry needling may be attributable to the placebo effects of this treatment. In this connection it is worth recalling that pain is a subjective variable that is dependent on the patient's psychological circumstances (Ross, 2004).

Trigger points may tighten the muscles and thus affect head and neck biomechanics; as a result they can restrict the range of motion. The treatment of trigger points was reported to improve restricted motion in joints (Fernández-de-las-Peñas et al., 2007b). Celik and Mutlu found that trigger points can cause limitation of motion along with pain, movement disorders, muscle cramps, muscle fatigue, changes in muscle activity patterns, and localized tenderness (Celik and Mutlu, 2013). Therefore, the effective management of these problems is of particular importance. Aguilera et al. and Cardoso et al. showed that the management of trigger points can increase joint range of motion (Cardoso de Sousa and Lima de Matos, 2014; Aguilera et al., 2009). It was thus unsurprising that range of motion improved following treatment in the present study. The results reported here showed that joint extension increased more in the dry needling group; however, the differences in other range of motion variables compared to the friction massage group were not statistically significant. Studies with larger sample sizes or longer treatment durations may reveal additional differences between the two treatment modes in their effect on joint range of motion.

To the best of our knowledge, few studies to date have been designed to determine the best treatment method for trigger points in patients with TTH. Currently, dry needling is considered a potential treatment option for trigger points in view of its claimed mechanical, neurophysiologic and chemical effects (Dommerholt, 2004). On the other hand, this is an invasive therapeutic mode, and it is important to determine the efficacy of dry needling in comparison to other, safer therapeutic methods.

In this study only the most important muscles were assessed and treated; however, any of the facial, cranial and cervical muscles may be involved in patients with TTH. Future studies should take into account that the assessment and treatment of all contributing muscles may provide more precise data on the efficacy of different treatment options for TTH.

5. Conclusion

It the present study only the muscles involved most frequently in TTH were evaluated and treated. Future studies should be designed to investigate the role of other possibly involved muscles and their response to different treatments.

The results of this study showed that dry needling and friction massage were equally effective in reducing the frequency and intensity of headaches, and in increasing cervical range of motion. However, the pain threshold increased significantly more after dry needling. Because dry needling is an invasive mode of treatment, friction massage is recommended as an effective therapeutic option for the treatment of TTH in patients who also have identifiable trigger points.

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Conflicts of interest

Not declared.

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