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ORIGINAL RESEARCH

The Investigation of the effects of deep dry needling into trigger points of temporalis, sternocleidomastoid and upper trapezius on females with episodic tension type headache

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Abstract

Introduction: Tension type headache is the most common type of headache that is associated with myofascial pain syndrome and trigger points. The aim of this study was to evaluate the efficacy of deep dry needling into trigger points of temporalis, sternocleidomastoid and upper trapezius muscles of females with episodic tension type headache.
Materials and Methods: The study was a clinical randomized, single-blind, parallel-group trial in which 24 participants were allocated into two groups. The first group received dry needling with passive stretching treatment and the second group (control group) received only passive stretching. Subjects were asked to record headache indices (headache intensity and frequency) for 4 weeks before treatment. Headache intensity and frequency and quality of life (SF-36) were measured at baseline and 4 weeks after the intervention.
Results: In the dry needling group, the intensity and frequency of headache and physical functioning scores of quality of life questionnaire were significantly improved after treatment ($p < 0.05$).
Conclusion: Due to the positive effects of deep dry needling and passive stretching in females with episodic tension type headache, the use of deep dry needling into trigger points of head and neck musculature is recommended in the presence of episodic tension type headache.

Keywords: Myofascial pain syndrome; Tension type headache; Dry needling, Trigger points; passive stretching

Introduction

Headache is the most common pain that has destructive effects on the person, body structure, participation, and quality of life according to the ICF standard [1]. According to the study conducted on the people with tension type headache, the quality of life and communication with colleagues and family decreases [2]. Types of primary headaches include tension, migraine, trigeminal autonomy, and other primary headaches [3]. Among the types of headaches, tension headaches are more prevalence (70%) [4, 5]. This type of headache is more common between the second and fifth decades [6]. The prevalence of this headache in developed countries is estimated at more than 80% in women and about 66% in men [7]. The International Headache Association divides tension headaches into episodic and chronic types based on the frequency of occurrence [8]. Episodic tension type headache occurs less than 15 days per month, while chronic tension type headache occurs more than 15 days per month. Between these two headaches, the episodic type with an annual occurrence about 38.3% is more prevalent compared to the chronic type with an annual occurrence (2.2%) [9]. Despite the studies conducted, the exact cause of this type of headache has not been mentioned yet [9]. However, in studies on tension type headache, the role of muscles in the mechanism of this type of headache has been considered [10, 11]. According to the recent studies, episodic tension type headache emphasize on the environmental factors, including environmental pain receptors and muscle factors, while it is discussed more about the role of the central nervous system in chronic tension type headache [12]. Also, some experimental studies show that the referral pain caused by trigger points in the shoulder and neck muscles as well as the surrounding soft tissues, including the fascia, tendon and ligament, causes pain in people with tension type headache [13, 14].

Myofascial pain syndrome is a common neuromuscular disorder and its characteristic is pain, stiffness, and the presence of trigger points in the muscle. Myofascial disorders are usually associated with local pain such as shoulder pain, backache and tension type headaches [15]. In people with tension type headache, many trigger points are found in the muscles around the neck and head [14]. According to some studies, active and latent trigger points are very common in people with tension type headaches [16, 17]. According to a study, a direct relationship was observed between the severity and frequency of headache and stiffness of the muscles around the neck and face [17]. Myofascial trigger points are very sensitive points inside the stiff band of skeletal muscle or myofascial that causes symptoms such as pain, sensitivity to touch and symptoms of autonomic nervous system when applying pressure on the involved tissue [18]. These points divided into two types, active and latent, which may be the source of problems such as referral pain, muscle weakness, disrupting of deep sensation, as well as headache and dizziness. The three most common muscles involved in people with episodic headaches with referral pain to the temporal area include the upper trapezius, sternocleidomastoid, and temporalis [19]. The trigger points located in the muscle have a specific referral pain pattern [20]. Effective treatments for headaches include medications and physiotherapy. Medications include ibuprofen, aspirin, and physiotherapy includes massage, stretching, mobilization and manual therapy including muscle energy techniques (MET), positional release, exercise therapy, postural correction, acupuncture and dry needling [21, 22]. Among the physiotherapy treatments, trigger points, dry needling therapy has been considered by physiotherapists in recent years compared to other treatments. In the last decade, dry needling has been considered in the treatment of headache and shoulder and neck pain syndrome [23]. Dry needling is the therapeutic intervention performed by therapists to improve myofascial pain syndrome [24].

In 2010, Kalichman and Valfsons introduced the dry needling as an easy and inexpensive treatment that could be one of the safest invasive modalities under proper training [25]. In this method, a fine sterile needle is used to penetrate the skin, subcutaneous tissues, fascia and muscles; the purpose of this method is to inactivate trigger points without the use of local anesthetics [26]. Regarding dry needling treatment, this hypothesis is proposed that dry needling stimulate serotonergic and noradrenergic pain inhibition ways and ultimately relieve pain [26]. A small number

of studies have been conducted about the effect of the physiotherapy treatments especially dry needling, on tension headache[9].

Further studies are needed to realize the therapeutic effects of dry needling on headache in the form of blind studies with random sampling and high sample size without any bias [9]. For this reason, research on the treatment approaches of dry needling on headache is expanding [9, 27]. According to our study, no study has been conducted on the effect of dry needling alone on the intensity and frequency of headache in people with episodic tension type headache. For this reason, the present study was conducted to investigate the effects of deep dry needling on the severity and frequency of headache in females with episodic tension type headache.

Materials and Methods

This study is a single-blind clinical trial and it has been registered in the Iranian trial registration system with code number IRCT20200129046302N1. The study population was selected among those who referred to Sina Hospital Headache Research Center in 2019. The present study was performed on 24 participants with episodic tension type headache. Inclusion criteria included women aged 18 to 50 years, no changes in the type or dose of the medication taken in the last 2 months, the presence of at least one active trigger point in one of the temporalis muscles (left or right), upper trapezius (left or right) and Sternocleidomastoid (left or right), people with episodic tension type headache based on ICHD-3 criteria. Participants were excluded from this study if they had 1) a history of neck trauma; 2) cervical radiculopathy; 3) previously had surgery in the neck or shoulder area; 4) a history of diagnosed other primary headaches; 5) trigger point therapy or Trigger-DN in the neck within the previous 6 months; 6) evidence of cognitive deficits; or needle phobia; 7) pregnant women; 8) people with cancer and infection and systemic diseases.

Detecting trigger points in sternocleidomastoid and upper trapezius was performed by pincer palpation method and in temporalis by flat palpation method [19]. After approval by the relevant neurologist, the candidates entered the study by evaluating the inclusion criteria and depression by the Beck questionnaire and then the complete description of the treatment, completing the consent form and the form related to the questionnaire of personal information. The subjects were given a headache diary questionnaire (intensity and frequency of headache) to complete 4 weeks before the treatment plan. Visual pain scale (VAS in centimeters) was used to measure the severity of headache. Finally, the average severity of headache was recorded. The headache frequency was also measured in terms of the number of days with a headache over 4 weeks. The sample size was calculated based on previous studies considering the alpha level of 0.05 and beta 0.8 [28]. Patients were randomly allocated to intervention and control group. The random allocation method of these two groups is block randomization, the size of the blocks is 6 people (there are 4 blocks totally) and the sequence of allocating patients to groups is determined using random allocation software. The intervention group received a deep dry needling with passive stretch and control group received a passive stretch session.

The effect of interventions on the subjects studied was examined from three aspects of headache diary (intensity and frequency of headache) and quality of life.

Quality of Life (SF-36): This questionnaire has 36 questions and consists of 8 subscales, and each subscale consists of 2 to 10 items. The eight subscales of this questionnaire include physical function, limitation in physical role, limitation in role of emotion, vitality, mental health, social functioning, pain and general health. The scores for each subscale are considered at 0-100, and a lower score indicates the lower quality of life. In the present study, the Persian version of this questionnaire was used and the validity and reliability of this questionnaire have already been confirmed by Motamed et al. [29]. The validity and reliability of this questionnaire have been confirmed in Iranian patients with headache [30].

Depression (Beck questionnaire): Depression in this study was measured by the score obtained in the Persian version of the Beck questionnaire during the last one-month. The questionnaire has 21 questions that

respondents had to answer on a four-point scale from zero to three. The total score is 63. Obtaining score above 28 indicates severe depression [31].The validity and reliability of the Persian version of this questionnaire has already been confirmed [32]. People with severe depression did not enter the study based on the score of the questionnaire. Dry needling technique: The needle used to treat trigger points in all muscles was 30 mm of length and 25 mm of diameter and it was made in South Korea. Patients were treated with dry needling following passive stretch only for one session.
Only one trigger point in each muscle (upper trapezius, the sternocleidomastoid and temporalis in both sides) was treated. If there was more than one trigger point (active or latent) in the relevant muscle, the trigger point with the highest sensitivity and pain was diagnosed and treated. After obtaining first local twitch response, the needle was removed with a quick motion and re-entered the area by fast in and fast out technique [33]. Finally, the dry needling treatment was completed by entering needle for 8 times with quick back and forth movement [34, 35]. Then in the same session and following deep dry needling, passive stretch was performed for upper trapezius, temporalis, and sternocleidomastoid muscles in the supine position, according to Travel and Simon [19]. The method of the passive stretching was such that the therapist performed the passive stretching of the aforementioned muscles slowly and without stimulating the pain. Stretch was maintained for 4 seconds in each muscle and then the muscle returned to rest position for 8 seconds. This procedure was repeated 3 times in each muscle. Deep dry needling and passive stretching were performed bilaterally on the target muscles [36, 37]. Control group: The method of applying passive stretching was the same as the intervention group. In this group, 3 participants were excluded and examined separately due to having tender point in the aforementioned muscles. The headache and quality of life indicators were re-evaluated 4 weeks later. During the treatment period, people were asked not to change the type of medication.
All data were collected in two temporal sections before and 4 weeks after treatment. Shapiro-wilk test was used to evaluate the numerical variables in terms of compliance with normal theoretical distribution. ANOVA test was used by repeating measurements to determine the effect of treatment and comparison between groups. Independent T-test was also used to find the difference of significant averages in both groups and between different treatment times. Also, T-pair test was used to evaluate the main effect of the variables studied in each group before and after treatment. SPSS software version 17 was evaluated and analyzed at a significant level of 0.05.

Results

The study consisted of 21 women (12 women in the intervention group and 9 women in the control group). The mean and standard deviation of patients' age in the intervention group (7.56) was 32.5 and in the control group (9.16) 37.44. In Table 1, the demographic information of the individuals was reported. No significant statistical difference was between the two groups in terms of age, height, and weight or body mass index.

Table 1: Demographic characteristics of participants

p-value	N=control group=9	N=intervention group=12	N=total number=21	Demographic variables
0.197	37.44 (9.16)	32.5 (7.56)	34/62 (8.44)	Age (year)
0.643	163.33 (4.66)	164.33 (4.92)	163/90 (4/72)	Height (cm)
0.852	67.11 (14.18)	68.17 (11.51)	67/71 (12.39)	Weight (kg)
0.942	25.12 (4.94)	25.27 (4.36)	25.21 (4.49)	BMI (Kg per square meter)

There was a significant statistical difference between the severity of headache in two groups at the beginning of the study (p=0.030). At the beginning of the study, there was no significant statistical difference between the two treatment groups in terms of headache frequency (p= 0.826) (Table 2).

Table 2. Mean and standard deviation of headache indicators (intensity and frequency of headache) in patients before intervention in two groups of intervention and control

p-value	Intervention group Mean (standard deviation)	Control group Mean (standard deviation)	Headache index
0.030	6.08 (1/23)	4.83 (1.17)	Headache intensity
0.826	11.08 (3.60)	11.44 (3.77)	Headache frequency

In terms of quality of life, there were no significant statistical differences between the two groups (Table 3).

Table 3. Mean and standard deviation of SF36 in patients before intervention in intervention and control group

p-value	Intervention group Mean (standard deviation)	Control group Mean (standard deviation)	SF36
0.651	65.83 (21.82)	70.55 (25.30)	Physical functioning
0.703	47.91 (37.62)	41.66 (35.35)	Role limitations due to physical health problems
0.850	55.55 (41.03)	51.85 (47.46)	Role limitations due to emotional problems
0.932	47.5 (21.26)	48.33 (22.77)	Vitality
0.406	51.83 (15.91)	58.22 (18.55)	Mental health
0.815	58.33 (25.18)	55.72 (24.76)	Social functioning
0.865	47.29 (24.80)	48.88 (14.52)	Bodily pain
0.487	55.83 (25.03)	48.33 (22.5)	General health

Table 4. Mean and standard deviation of headache intensity of people with episodic tension type headache in two groups over time

p-value between group	p-value Within group	Difference	4 weeks after treatment	Before treatment	Group
0.003	0.023	0.28 (0.30)	5.12 (1.08)	4.83 (1.17)	Control
	0.017	-0.55 (0.68)	5.52 (1.07)	6.08 (1.23)	Intervention

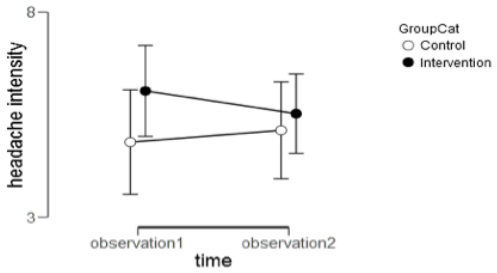

Figure 1. Variable of the headache intensity in two groups

Statistically, changes in headache intensity were significant after one month of intervention in the control group (p= 0.023), and also in the intervention group (p= 0.017). One month after the intervention, there was a significant difference between the changes in headache intensity in the two groups (p= 0.003) (Table 4) (Figure 1).

Table 5. Mean and standard deviation of headache frequency of people with episodic tension type headache in two groups over time

p-value between group	p-value within-group	Difference	4 weeks after treatment	Before treatment	Group
0.018	0.805	0.33 (0.5)	11.77 (3.96)	11.44 (3.77)	Control
	0.021	-0.66 (1.07)	10.33 (3.67)	11.08 (3.60)	Intervention

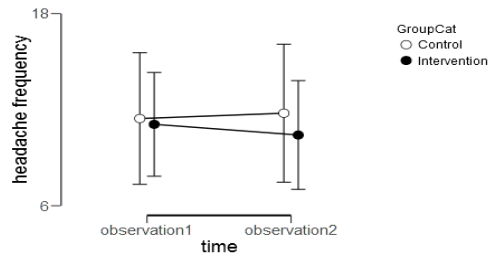

Figure 2. Variable of the headache frequency in two groups

Statistically, changes of headache frequency were not significant after 4 weeks of intervention in the control group (p= 0.805), but it was significant in the intervention group (p= 0.021). There was a significant difference between the frequency changes of headache between two groups after 4 weeks of intervention (p= 0.018) (Table 5) (Figure 2).

Table 6. Mean and standard deviation of quality of life changes in people with episodic tension type headache 4 weeks after treatment in two groups

p-value	Intervention	Control		Line
0.008	5.0(-2.29, 12.29)	-10.55(-18.80, -2.30)	Physical functioning	1
0.462	10.41(8.08, 28.91)	0.02(-9.60, 9.60)	Role limitations due to physical health problems	2
0.905	11.11(-16.47, 38.70)	11.11(-1.69, 23.91)	Role limitations due to emotional problems	3
0.260	10.41(-6.08, 26.92)	-2.77(-12.23, 6.65)	Vitality	4
0.226	7.5(-5.81, 20.81)	-3.55(-11.15, 4.04)	Mental health	5
0.127	7.29(-4.17, 18.75)	-7.11(-18.92, 4.70)	Social function	6
0.341	10.83(-5.08, 26.75)	-1.66(-9.64, 6.30)	Bodily pain	7
0.250	6.66(-0.66, 14.0)	2.77(-11.12, 16.78)	General health	8

In terms of changes in physical functioning of quality of life, there was a significant difference between the control and intervention groups (p= 0.008), in the other areas of quality of life, there was no significant difference between the two groups of intervention and control (Table 6).

Discussion

According to the recent studies, environmental factors including environmental pain receptors and muscle factors are emphasized in episodic tension type headache while the role of the central nervous system in chronic tension headaches has been discussed further[38, 39] .The trigger points in the neck and shoulder area cause referral pain and headache symptoms in people with tension headache [11, 41]. Also, in some previous studies, a direct relationship has been found between the number of trigger points and tension type headache indicators [40, 41].This study was performed to investigate the dry needling in the active and latent trigger points of the sternocleidomastoid, temporalis, and upper trapezius muscles in women with episodic tension type headache. The results of this study on the intensity and frequency of headache showed that dry needling caused a significant improvement in headache indicators. The results of the present study were consistent with the results of Karakurum, which showed that in people with tension headache, deep dry needling improve

headache indicators (frequency, intensity of headaches), although no significant difference was observed between control groups (sham dry needling) and intervention group (deep dry needling) in terms of headache indicators [42]. Gilder also showed in a study conducted on 160 patients with chronic tension headache that 6 sessions of deep dry needling treatment significantly improved headache indicators (intensity, frequency and duration of headache) during follow-up for 1 month in the group of deep dry needling (dry needling in active trigger points) compared to sham dry needling (dry needling method was used in adipose tissue located in any area where there are no active trigger points)[43] .in line with previous studies, Kamali et al. [14] also showed that headache indicators (frequency and intensity of headache) in both friction massage group and deep dry needling in trigger points improves in people with chronic tension headache. However, no significant difference was observed between the two groups of headache indicators. However, the duration of follow-up in Kamali's study was 1 week. Some studies have shown that physiological and psychological effects of manual therapies (dry needling and massage) on the treatment of chronic pains depend on time due to the role of complex central structures in chronic pain, and the assigned time to observe changes is considered to be 6 weeks [44, 45]. France et al. In a systemic review found that despite adequate studies, dry needling may be effective in treating headache [9].

One of the reasons for the effectiveness of dry needling treatment in the improvement of headache indicators is related to the physiological effects of the needle. Micro-mechanical stimulations by the needle while performing the procedure can cause local traction of sarcomeres and reduce muscle stiffness [26]. These stimuli are not necessarily in the trigger points. It can also occur at the distant site of implementation. In addition, other studies show that the movement of needle back and forth into muscle fibers (such as the dry needling method in the present study) stimulates delta A and C fibers, which are involved in the secretion of enkephalinergic, serotonergic and noradrenergic inhibitory systems. The secretion of these substances can be a factor in reducing pain through pain-suppressing mechanisms [26, 46].

Another study by Ghanbari on people with tension headache showed that 5 sessions of positional release for 2 weeks did not have a significant effect on reducing the intensity of headache[28]. It should be noted that the previous treatment is an indirect method for treating trigger points. Also, the method of measuring pain was performed by NPI questionnaire, which has a more limited option compared to VAS or other methods of measuring pain in the differentiation of pain level [47].

The results of this study showed that performing passive stretch alone without inactivating trigger points may stimulate and increase the sensitivity of trigger points. It is likely that the increase in headache intensity in the control group may also be due to increase sensitivity of the trigger points following passive stretching. The results of the present study about the intensity of headache in the control group are consistent with the study conducted by Tellez et al. [36]on people with neck pain.

Although some other studies indicate that stretch is effective in treating primary headaches[22, 48] .The causes of different results in studies can be attributed to the time and type of stretch, the number of sessions, performing stretch by different people or by the patient (the stretching may not be done properly) in different studies.

Tension headache reduces quality of life in individuals and significantly affect a person's family, family relationships, and work [49]. According to Marcelo's study, the quality of life in people with episodic tension type headache similar to migraine is greatly reduced[50] .Holroyd also found in a study that people with tension headache had lower scores compared to the control group in the SF-12 questionnaire. They had lower level of energy and sleep quality compared to healthy group [51]. In this study, the areas of quality of life in people with episodic tension type headache were examined.

Based on the results obtained in the field of physical performance, a significant improvement was observed in the group of deep dry needling compared to the control group. In other areas of quality of life, the difference between the two groups was not

significant. Gildir in a study on people with chronic headache showed that 6 sessions of deep dry needling in 2 weeks improved the quality of life in all 8 areas during 1-month follow-up after treatment with deep dry needling in trigger points[43].In this study, similar to the present study, physical functioning was improved in the deep dry needling group. This improvement in the physical functioning of quality of life indicates the effectiveness of the one-session method of dry needling by reducing the intensity of headache, because pain has a direct effect on range of motion and therefore physical performance through the reflexive inhibition of skeletal muscles [52]. Regarding the lack of significant changes in other areas of quality of life in this study, it should be noted that body pain in quality of life may include other pains that a person suffers from, so it may not be considered as a specific variable in this treatment. People with headache may have other muscle and skeletal problems, which reduces work and social activity, and thus it affects the patient's understanding of mental and social health. In a study conducted by Gildir, the quality of life in chronic tension type headache has been studied. According to some studies, manual therapies (dry needling and massage) balance the secretion of substances such as norepinephrine and serotonin through the central system, which are effective in psychological manifestations and understanding the patient's pain. Psychological aspect of chronic pains is more prominent than in other types of pain [53]. Due to the long duration of treatment in Gildir's study, this factor can be effective in the patient's perception and expectations [54]. Also, changes in mental health depend on the time and duration of treatment.

In this study, people filled out the quality of life questionnaire at the treatment place and under the supervision of physiotherapist. However, in many studies the evaluation of the quality of life is sent and measured via email. Other researchers have not discussed about this case. In some studies, interventions were taken place by patients, which is a factor in changing the outcome and reducing patients' adherence to the treatment process [55].

One of the limitations of the present study is the low sample size and its short-term treatment follow-up. Given that some changes in the items of the questionnaire needed time, the short time follow-up of the therapeutic period can cause a difference in reporting real scores. It is recommended to investigate the effect of dry needling in trigger points of other muscles in people with episodic tension type headache. It is also recommended to compare the dry needling method with other methods and the stability of the treatment effect with dry needling after spending time in employed people.

Conclusion

The results of the study indicate the positive effects of deep dry needling on the improvement of headache indicators. According to the cost-effectiveness of these therapeutic methods in terms of time and cost, it is recommended to use these therapeutic methods in the treatment of patients with tension type headache.

Conflict of interest

Authors declare no conflict of interest.

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