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Effects of Myofascial Release and Posture Correction Exercise on the Neck Movement and the Quality of Sleep in Patients with Chronic Tension-Type Headaches

Background: Tension-type headaches, which make up the highest proportion of headaches, are prone to develop into chronic tension-type headaches (CTTH). The characteristic of CTTH in patients is that the active myofascial trigger point (ATrP) which causes pain in the muscles of the back of the head is increased, compared to the normal headache and moves the head position forward.
Objective: The aim of this study was to investigate the effects of myofascial release (MFR) and posture correction in effectively improving neck function and sleep quality in the symptoms of CTTH patients.
Design: Observer-blind study
Methods: To reduce ATrP, MFR was applied and exercise was also applied to correct posture. The subjects of this study were 48 individuals randomly divided into three groups; The MFR group using the MFR technique; The MFR with exercise group subject to both the MFR technique and forward head position correction exercises (MFREx), and the control group. MFR and MFREx groups were given the relevant interventions twice a week for four consecutive weeks, and went through the number ATrPs, range of motion (ROM) of neck, Neck Disability Index (NDI) and the Pittsburgh Sleep Quality Index (PSQI) before and after the intervention. A physical therapist, who was fully familiar with the measuring methods of the equipment, was the measurer and not aware of the target's condition was blinded to take measurements only before and after intervention.
Results: There was a significant improvement in the ATrP, Neck ROM, NDI and PSQI in the group of patients to whom the MFR technique and MFREx were applied. MFREx was more effective in increasing neck mobility.
Conclusions: According to this study, the application of MFR is effective in improving neck movement and sleep quality in chronic tension headache patients.

Key words: *Active trigger point; Myofascial release; Exercise; Chronic tension-type headache; Sleep quality; Suboccipital muscle*

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INTRODUCTION

Headaches are defined as pain experienced in the head and neck area. The discomfort and social costs caused by headaches increase the burden on society as a whole, beyond the problems of the individual and his family. Therefore, the World Health Organization (WHO) defines headaches as one of the top 10 threats to human health (five for women).[1] The most common form of headache is tension-type headache (TTH) and is a "primary headache" whose cause is unclear.[2]

TTH is exacerbated by fatigue or stress, and pain mainly occurs in both parietal lobes and the posterior of the head. [3] The prevalence of tension headache is steadily increasing and is most likely to lead to chronic tension-type headache (CTTH).[4,5] In addition to pain, CTTH can also cause other disorders, including sleep disorders and decreased neck range of motion (ROM).[6]

Many methods, including medication, have been applied to treat TTH, but simply taking painkillers for a long period of time can cause side effects such as drug addiction, weight gain, drowsiness, as well as secondary headaches, and drug overdose.[7] In the case of CTTH with TTH lasting more than 3 months, taking frequent painkillers make treatment more difficult, and regular pain medications that is taken two or three times a week may cause drug overuse headaches. [1]

The pathogenesis of TTH is not yet clear. However, CTTH patients have several symptoms that distinguish them from normal people. In patients with CTTH, active myofascial trigger points (ATrP) that cause pain in the muscles of suboccipital area are increased compared to those of normal people, and forward head posture (FHP) is increased.[6] In addition, patients with TTH in the FHP reported that the ROM of neck was lower than that of normal people.[8] ATrP is thought to be a major cause of TTH. [9]

A common technique used by clinicians to remove ATrP is MFR. It has been reported that MFR on the neck and head of CTTH patients has an immediate effect in relieving muscle tension and reducing pain.[10]

The aim of this study was to investigate the effects of ATrP reduction and posture correction in effectively improving neck function and sleep quality symptoms of CTTH.

SUBJECTS AND METHODS

Subjects

Treatment This research study was conducted with 60 CTTH patients who voluntarily agreed to participate and understood the purpose and procedure of the study. Participants were recruited through a recruitment notice in a hospital at five places, located in Busan. Subjects were those diagnosed with CTTH by neurologists based on the criteria of the International Headache Society (2013)[3] and subject to participation: Patients with chronic headaches lasting longer than 3 months and symptoms that persist for more than 15 days in a month. Pain is a bilateral or tight feeling of pressure, pain intensity is less than moderate enough for everyday life and is not aggravated by physical activity such as climbing stairs. This study was approved by Kaya University Ethics Committee (Kaya IRB-233).

Interventions

The study was randomized into three groups of 20 people per group. The treatment groups were divided into two groups: myofascial release (MFR) group, myofascial release with exercise (MFREx) group. The third group was a control group. During the experiment, 4 absentees from the MFR group (n=16), 5 from the MFREx group (n=15) , and 3 absentees from the control group (n=17) were measured.

Myofascial release group

The MFR group treatment was conducted by two physiotherapists with at least five years of clinical experience who were fully familiar with MFR technique. A total of 15 minutes of interventions were conducted per session. For a more efficient suboccipital muscle inhibition application, the MFR technique was applied on the upper trapezius muscles, which are located on the outer side of the suboccipital muscles, for five minutes in advance. A ten-minute suboccipital muscle MFR was applied to complete a 15-minute session of myofascial release technique. The application of fascia release was a partial modification of the fascia release applied by Manheim (2001).[11]

Myofascial release and Exercise group

The MFREx group applied three additional FHP correction exercises, after applying the MFR technique. In the first and second week, the FHP correction exercise (Pectoral muscle stretching, Wall leaned chin-in, Thoracic extension on foam roller) proposed by Harman[12] was used. In the third and fourth week, the exercises (Upper trapezius stretching, Against the wall chin-in, Pelvic control followed by thoracic extension) to strengthen and control posture proposed by Comerford et al.[13] were used. To maximize the effect of the correction exercises, the subjects were instructed to do an additional, three times a week at home, exercise for a total of five of exercise sessions per week.

Control group

The control group was diagnosed with CTTH and no intervention was applied.

Measurements

The measurer, a physiotherapist who was fully familiar with the measurement method of the equipment, did not know the condition of the subject and was blinded to enter and measure only before and after the intervention. In addition, the reliability was measured to increase the measurement reliability. All measurements were taken before and after 4 weeks of intervention.

ATrP

In the measurement of ATrP, a pressure algometer was used (JTECH Medical, USA). The algometer was used again for measuring the pressure of soft tissue. The suboccipital muscle has sensitive soft tissues so the pressure was set at 1.5 kg/cm^2, which is lower than the 2.5 kg/cm^2 calibration used for myofascial trigger point (TrP) in soft tissues applied to patients with upper trapezius myofascial pain syndrome,[14] and can be converted to 14.7 N/cm^2 in the Newtonian value. The area for measurement was confined to suboccipital muscles ranging from the lower part of the rear of the head to around C2 of the cervical vertebrae area, using a force plate with a size of 1cm^2 placed for 10 seconds on 30 spots in total - based on the spinous process, five spots each on the left and right inferior nuchal lines, another five spots each on the left and right side of C1, and the other five spots each on the left and right side of C2 (Fig 1). A sustained pressure of about 10 seconds on the suboccipital muscular trigger points lead to referred pain,[6] which was assessed as "active" if the patient was familiar with it in his/her everyday life.[15,16]

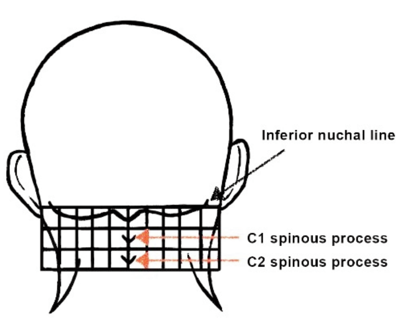

Fig. 1. TrP measurement position

ROM

The neck ROM was measured using an inclinometer (JTECH Medical, USA). ROM was measured by the angle of flexion and extension. All the mobility measurements were used three times for each operation using the average value. In this study, the reliability test was conducted before and after the experiment to improve the reliability of the measurement (ICC = 0.78–0.99).

NDI

The neck disability index (NDI) was measured using the Korean version of the wooden disability index evaluation table.[17] It is known as a measuring instrument with high reliability (ICC = 0.59–0.89) for NDI neck disability.[18] 0–8 = no disability, 10–28 = slight disability, 30–48 = moderate disability, 50–68 = severe disability, 70 or more = complete disability.[19]

PSQI

The Pittsburgh Sleep Quality Index (PSQI) is a measure of sleep quality that includes 19 self-assessment questions and 5 sleep questions. 0 indicates no difficulty, and 21 indicates serious difficulties throughout. The measurement of the sleep quality index was done using the Korean version of the Pittsburgh Sleep Index, which was written in Korean by Sohn et al.[20]

Statistical Analyses

The Wilcoxon signed-rank test was used for intra-groups, pre and post comparison on the ATrP, ROM, NDI and PSQI was used to assess the impact of the MFR technique and FHP correction exercise. The One-way analysis of variance (one-way ANOVA) was used to compare the intervention effect in the MFR group, the MFREx group, and the control group. The Tukey test for multiple comparison was used for the post hoc test. The level of .05 to validate the statistical significance and the collected data was analyzed using the SPSS 18.0.

RESULTS

The demographics of the subjects in the study are described in the table below (Table 1). There was no significant difference in the characteristics of the participants among the groups.

ATrP

Before and after intervention, ATrP was significantly decreased in both MFR and MFREx groups ($p<.05$) (Table 2). There was a significant decrease in ATrP between groups in the MFR and MFREx groups ($p<.05$) (Table 3).

ROM

Flexion was significantly increased in both MFR and MFREx groups before and after intervention ($p<.05$) and extension was significantly increased, only, in

MFREx group (Table 2). There was a significant increase in flexion between groups in the MFR and MFREx groups ($p < .05$) (Table 3).

NDI

NDI was significantly decreased in both MFR and MFREx groups before and after intervention ($p < .05$), but significantly increased in the control group ($p < .05$). NDI was significantly decreased in the MFR and MFREx groups compared to the control group ($p < .05$) (Table 3).

PSQI

PSQI was significantly reduced in both MFR and MFREx groups before and after intervention ($p < .05$). PSQI among the groups was significantly decreased in the MFR and MFREx groups compared to the control group ($p < .05$) (Table 3).

Table 1. Characteristics of subjects

Variables	MFR (n = 16)	MFREx (n = 15)	Control (n = 17)	p
Age (yr)	33.23 ± 8.74	35.56 ± 8.57	38.07 ± 10.94	.671
Gender (M/F)	5 /11	4/11	5/12	.587
Height (cm)	160.83 ± 7.71	161.59 ± 9.32	159.92 ± 7.23	.761
Weight (kg)	58.24 ± 11.54	59.14 ± 11.32	57.44 ± 10.93	.970
Duration of Headache (yr)	3.43 ± 1.87	3.19 ± 2.31	3.22 ± 1.56	.827

MFR:Myofascial release group, MFREx:MFR + Correction Exercise group, Contro: Control group

Table 2. Comparison of change in ATrP, ROM, NDI and PSQI within group

		Pre	Post	p
ATrP (ea)	MFR	7.34 ± 2.84	3.42 ± 1.62	.011*
	MFREx	7.37 ± 3.32	3.27 ± 3.46	.013*
	Control	6.27 ± 1.72	7.24 ± 4.42	.341
Flex (°)	MFR	41.54 ± 12.57	51.33 ± 15.22	.018*
	MFREx	39.58 ± 13.29	50.78 ± 9.16	.008*
	Control	43.74 ± 6.48	45.14 ± 9.57	.291
Ext (°)	MFR	51.29 ± 12.98	55.17 ± 15.34	.271
	MFREx	50.62 ± 15.52	62.77 ± 11.93	.032*
	Control	57.14 ± 7.43	56.57 ± 3.83	.784
NDI (score)	MFR	42.33 ± 11.24	24.78 ± 18.12	.007*
	MFREx	35.92 ± 12.83	22.48 ± 13.52	.004*
	Control	36.42 ± 7.71	42.34 ± 7.48	.045*
PSQI (score)	MFR	13.52 ± 3.98	10.21 ± 2.98	.017*
	MFREx	13.86 ± 4.71	10.75 ± 3.77	.011*
	Control	13.41 ± 4.97	13.13 ± 5.24	.723

*$P < .05$, MFR:Myofascial release group, MFREx:MFR + Correction Exercise group, Contro: Control group, ATrP; Active Myofascial Trigger Points, Flex; Flexion, Ext; Extension, NDI; Neck Disability Index, PSQI; Pittsburg Sleep Quality Index

Table 3. Comparison of change ATrP, ROM, NDI and PSQI between group

	MFR (post − pre)	MFREx (post − pre)	Contro (post − pre)	p
ATrP (ea)	−3.92 ± 2.14[a]	−4.10 ± 2.83[a]	0.97 ± 2.48[b]	0.004* (a,b<c)
Flex (°)	9.79 ± 8.48[a]	11.20 ± 9.52[a]	1.40 ± 6.21[b]	0.012* (a,b>c)
Ext (°)	3.88 ± 12.46	12.20 ± 16.41	−0.57 ± 6.82	.065
NDI (score)	−17.55 ± 17.02[a]	−13.44 ± 16.58[a]	5.92 ± 7.72[b]	0.003* (a,b<c)
PSQI (score)	−3.31 ± 3.65[a]	−3.11 ± 3.44[a]	−0.28 ± 3.93[b]	0.021* (a,b<c)

*P < .05, [a]MFR:Myofascial release group, [b]MFREx:MFR + Correction Exercise group, [c]Contro: Control group, ATrP; Active Myofascial Trigger Points, Flex; Flexion, Ext; Extension, NDI; Neck Disability Index, PSQI; Pittsburg Sleep Quality Index

DISCUSSION

ATrP may be activated by acute factors such as muscle sprains, or slowly by chronic overloads such as incorrect posture. ATrP causes myofascial pain syndrome, which can lead to decreased joint range, muscle weakness, and sleep disorders.[16]

As a result, MFR and MFR with correction exercise applied to CTTH patients were found to be effective in reducing ATrP, increasing neck function and improving sleep quality. This factor is probably due to the reduction of ATrP in the suboccipital muscle. Eliminating ATrP plays an important role in treating headaches in CTTH patients. The MFR group in the suboccipital muscle area of this study decreased from 7.34 pre-intervention ATrP to 3.42 post-intervention average, resulting in a 53% reduction in ATrP in one month. In the MFREx group, the average number of ATrPs was 3.27, down from 7.37, to 56%. Both interventions have been shown to contribute to improving symptoms in CTTH patients. In contrast, the control group increased from 6.27 before the experiment to 7.24 after the experiment for 4 weeks, indicating that ATrP does not disappear by itself over time.

Another factor that may have contributed to the reduction of CTTH headache was the increased flexibility of the suboccipital muscle. Most muscles in the body are organically linked to each other, so measuring the flexibility of a single particular muscle is quite difficult. Moreover, for suboccipital muscles, there is no specific way to measure changes in flexibility, but this can be estimated from changes in neck mobility. The suboccipital muscle is attached to the inferior nuchal line below the back of the head and to the upper cervical vertebrae, which acts to flex and stretch the neck. The increase in flexibility is evidenced by the increased range of motion of the muscles. Sandman et al., reported that stress negatively affects posture, which causes myofascial pain syndrome.[21] According to him, stress increases the release of excitatory neurotransmitters in the brain, which increases muscle tension, causing postural changes. As muscle contraction increases, nerves become overactive, which increases reflex vasoconstriction, causing oxygen starvation, and increasing local ischemia and local pressure. This causes the persistence of myofascial pain syndrome.

The intervention in this study showed an increased range of motion in the neck flexion with increased suboccipital muscle. In patients with TTH, neck bending is known to be less than healthy,[8] this is presumed to be due to reduced flexibility due to increased tension in the suboccipital muscles.

As the tension in the muscle increases, the actin and myosin, the source fibers, also become flexible. Increasing the length of the myofibril in actin and myosin reduces muscle tension, which in turn reduces the excessive activity of nerves. Increasing the relaxation of the locally tense area increases local blood circulation, reducing metabolic residues accumulated in the muscles, thereby reducing pain at the fascia point. Therefore, the cause of myofascial relaxation and correction exercise under the back of the head may play a role in reducing headache and increasing neck mobility.

CONCLUSION

The results of this study show that the application of MFR effectively reduces ATrP in the suboccipital muscle region, which contributes to the improvement of neck function and sleep quality. Combined with the MFR and the correction exercise, the neck mobility was more effective. Therefore, reduction of ATrP and posture correction exercise were found to be a more effective intervention method for CTTH patients.

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