Effects of relaxation approach with self-exercise on head posture, static postural stability, and headache in persons with tension-type headache

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Objective: Tension-type headache is caused by hormones, foods, irritants, stress, obesity, fatigue, and neck and head trigger points-prolonged abnormal posture. The purpose of this study was to evaluate the effects of relaxation approach on head posture, static postural stability, and headache in persons with tension-type headache.

Design: Randomized controlled trial.

Methods: Thirty-five persons with tension-type headache participated in this study. This study was a pretest-posttest with a control group design for a duration of 4 weeks (60 min/3 times/1 wk). The participants were randomly allocated to the relaxation approach group (n=18) and the control group with conventional rehabilitation including thermotherapy and transcutaneous electrical stimulation for the same period (n=17). Outcome measures involved forward head posture (FHP), foot pressure, neck disability index (NDI), and six-item headache impact test (HIT-6).

Results: Relaxation approach and control groups improved significantly in the amount of forward head posture, neck disability index, and six-item headache impact test scores after training ($p<0.05$). The control group was found to be significantly different in the amount of FHP, backward foot pressure, NDI, and HIT-6 after training compared to before training ($p<0.05$). The relaxation approach group significantly improved in forward head posture, neck disability index, and six-item headache impact test compared with control group after training ($p<0.05$). Neck disability index and six-item headache impact test significantly improved after training compared with before training in the control group ($p<0.05$). However, the foot pressure was not significantly different between relaxation approach and control groups.

Conclusions: This study suggests that treatment with relaxation approach combined with self-exercise would be effective in reducing the amount of forward head posture, neck disability and headache impacts.

Key Words: Exercise, Manual therapies, Tension headache

Introduction

Primary headache disorders are highly prevalent among the population affecting millions of people world-wide. Common types of primary headache disorders are migraine and tension-type headaches (TTH). TTH is subcategorized as episodic TTH or chronic TTH [1]. The most common headache type is TTH, which has a high prevalence of 27%

compared to migraine of 5%. TTH symptoms are defined as tight gripping pressure and constant pain in bitemporal, occipital, retro-orbital, frontal or occipital sites [2]. TTH depends on current hormones, foods, irritants, stress, obesity, fatigue, and muscle disorders at neck and head trigger points caused by prolonged abnormal posture [3,4]. Symptoms secondary to TTH are associated with gastrointestinal symptoms such as nausea and vomiting, sleep disturbance, and visu-

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al symptoms, including teichopsia, fortification spectra or blurred vision [3]. Therefore, TTH produces a major daily and social activity limitation with participation restriction in daily activities, social or community-dwelling and ultimately affecting quality of life.

Management of TTH is commonly divided two approaches including pharmacological intervention and non-pharmacological intervention. Taking repetitive medication can lead to an increase in the prevalence of side effects and may show symptoms of poisoning, although best management of TTH is a pharmacological approach such as tricyclic antidepressants [5]. In previous studies, the non-pharmacological approaches have been reported in spinal manipulation, massage, connective tissue massage, spinal mobilization and manual traction to relieve TTH [1,5-11]. Espi-Lopez and colleagues studied to assess the effectiveness of relaxation approach techniques applied to the suboccipital region, on the aspect of disability in a sample of patients with TTH [7]. Ferragut-Garcías *et al.* [11] studied to evaluate the effects of a protocol involving soft tissue techniques and neural mobilization techniques in the management of patients with TTH. They reported the application of soft tissue and neural mobilization techniques to patients with TTH induces significant changes in pressure pain threshold, the characteristics of pain crisis, and its effect on activities of daily living as compared with the application of these techniques as isolated interventions. Monzani *et al.* [10] studied to evaluate the efficacy of manual therapy for TTH in restoring workers quality of work life, and how work presenteeism affects this relation. They reported that articular manipulation technique is a more efficient treatment to improve quality of work life when the frequency of work presenteeism is high.

As mentioned above, previous studies of non-pharmacological approaches have been reported to focus the relief of TTH, but they have been evaluated insufficiently to inves-

tigate the relationship between body posture-related pain, proprioceptive information, and TTH [12]. The purpose of this study was to evaluate the effects of relaxation approach on head posture, static postural stability, and headache in persons with TTH. This study provided the relaxation exercise combined with self-exercise at peri-neck muscles as therapeutic approaches to improve the head posture, static postural stability, and TTH.

Methods

Subjects

Thirty-five persons with TTH participated in this study. All subjects had a diagnosis of TTH confirmed by a physician who had no involvement in similar therapeutic programs as this study. The inclusion criteria were as follows: persons without any visual deficits or vestibular deficits, persons without any surgical history within three months, persons without any congenital or systematic deficits at musculoskeletal system, and persons without any neurological deficits. The exclusion criteria included persons with cranial aneurysms and persons with contraindications of receiving manual therapy. The participants were recruited through a local rehabilitation center and were motivated to participate in this study spontaneously. This study was carried out in accordance with the International Ethical Guidelines and Declaration of Helsinki and was approved by the Baekseok University institutional review board (BUIRB-

Table 1. Common characteristics of participants (N=35)

Variable	Relaxation approach group (n=18)	Control group (n=17)	t(p)
Age (y)	39.6 (15.9)	41.0 (9.4)	-0.325 (0.747)
Height (cm)	161.2 (7.9)	159.5 (6.5)	0.709 (0.483)
Weight (kg)	61.9 (9.3)	65.0 (12.6)	-0.828 (0.414)
BMI (kg/m ²)	23.8 (2.6)	25.2 (4.2)	-1.208 (0.236)

Values are presented as mean (SD).

BMI: body mass index.

Figure 1. The experimental procedure of this study.

201602-HR-003). The characteristics of participants are shown Table 1.

Procedure

This study was a pretest-posttest with a control group design with a duration of 4 weeks (60 min/3 times/1 wk). The participants were randomly allocated to the relaxation approach group (n=18) and the control group with conventional rehabilitation approaches (n=17) by randomly choosing an envelope that had a name tag of a group name. Figure 1 shows the processing of this study. The relaxation approach group conducted the relaxation approaches at suboccipitals, sternoclavicularomastoid, and upper trapezius muscles (30 min/3 times/1 wk) added with self-exercise including deep neck flexor exercise, foam roller thoracic stretching, black burn exercise, and foundation exercise (30 min/3 times/1 wk). Figure 2 shows the relaxation approaches as a relaxation approach, and Figure 3 shows the self-exercise for the peri-neck muscles. The conventional rehabilitation approaches were therapeutic approaches with physical agents including thermotherapy and transcutaneous electrical stimulation for same period.

Outcome measures

This study used the Body style S-8.0 (LU Commerce, Seoul, Korea) with the body style analyzer to measure the amount of forward head posture (FHP). Participants were asked to stand on the posture pad and pictures were taken at lateral view. The FHP measured the right tragus, acromion, and spinous process of C7. FHP was defined as a forward shoulder angle of 50 degree or less [13]. GHW treadmill walking analysis system (GHF-550; GHWell Co., Ltd.,

Yangju, Korea) was used to measure foot pressure in this study. The tool is able to measure static foot pressure and dynamic walking analysis with 2D and 3D viewer function. The tool consists of a treadmill ergometer with an integrated pressure sensor mat comprising of a matrix of high-quality capacitive force sensors (pressure ranges, 0.20-125 N/cm²; total number of sense, 128×48). This study measured static foot pressure measurement at anterior-posterior and left-right side.

This study measured two clinical tools to evaluate the therapeutic effects of relaxation approach on TTH. Neck disability index (NDI) is a modification of the Oswestry low back pain disability index, and has the most commonly used self-report measure for neck pain. It is a patient-completed, condition-specific functional status questionnaire with 10 items including pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping and recreation. The tool is 5-ordinal scale from 1 (I can't) to 5 (I can), with a maximum score 50. If all ten sections are completed, the score is transformed to a percentage score. The NDI has good reliability and validity in persons with mechanical neck pain [14]. The six-item headache impact test (HIT-6) was designed to provide a global measure of adverse headache impact and was developed to use in screening patients with headaches in both research and clinical settings. The HIT-6 items measure the adverse impact of headache on social functioning, role functioning, vitality, cognitive functioning, psychological distress, and the severity of headache pain. The tool yields an impact score from 36 (minimum score) to 78 (maximum score). The scores of HIT-6 were translated into 4 grades: grade 1 (little or no impact; score ≤49), grade 2 (moderate impact; score, 50 to 55), grade 3

Figure 2. Relaxation approaches of manual therapy at suboccipital, sternoclavicularomastoid, and upper trapezius muscles. (A) Suboccipital muscle, (B) sternoclavicularomastoid muscle, (C) upper trapezius muscle.

Figure 3. Relaxation approaches of Manual Therapy at suboccipital, sternoclavicular, and upper trapezius muscles. (A) Deep neck flexor, (B) foam roller thoracic stretching, (C) foundation (founder), (D) black burn Y-typed, (E), black burn T-typed, (F) black burn W-typed.

(substantial impact; score, 56 to 59), and grade 4 (severe impact; score ≥ 60). The HIT-6 has good internal consistency and test-retest reliability, and constructs validity [15,16].

Statistical analysis

The dependent variables were FHP, foot pressure, NDI, and HIT-6 and the independent variable was the relaxation program as a relaxation approach with self-exercise at peri-neck muscles in this study. Descriptive statistics was used to define the common characteristics (mean, standard deviation, and range) of the participants of this study. To analyze homogeneity between two groups, this study used an independent t-test for age, height, weight, and body mass in-

dex of the participants. Paired t-test used to define the differences between pretest and posttest in each group, and independent t-test was used to define the differences between relaxation approach and control groups after 4 weeks of training. All statistical calculations were performed using the IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA). The significance level was set at $\alpha = 0.05$.

Results

This study measured the amount of neck disability and headache impact to evaluate the treatment effects after training. The relaxation approach group improved sig-

Table 2. Comparison between pretest and posttest in relaxation approach group (N=18)

Variable	Pretest	Posttest	t(p)
FHP angle (mm)	35.3 (14.2)	15.3 (11.2)	7.819 (<0.001)
Foot pressure (%)			
Left side	51.1 (4.2)	51.3 (1.7)	-0.290 (0.776)
Right side	48.9 (4.2)	48.5 (1.8)	0.489 (0.631)
Forward	42.9 (14.8)	43.7 (11.9)	-0.463 (0.649)
Backward	57.1 (14.8)	56.1 (11.9)	0.594 (0.561)
NDI (score)	24.2 (5.9)	12.0 (5.7)	13.439 (<0.001)
HIT-6 (score)	60.3 (4.7)	44.3 (6.0)	11.513 (<0.001)

Values are presented as mean (SD).

FHP: forward head posture, NDI: neck disability index, HIT-6: six-item headache impact test.

Table 3. Comparison between pretest and posttest in participants of control group (N=17)

Variable	Pretest	Posttest	t(p)
FHD angle (mm)	18.7 (10.9)	27.1 (12.4)	-2.637 (0.018)
Foot pressure (%)			
Left side	53.8 (6.5)	51.2 (3.1)	1.637 (0.121)
Right side	46.1 (6.4)	48.7 (3.1)	-1.634 (0.122)
Forward	44.8 (14.1)	43.8 (10.3)	0.265 (0.794)
Backward	63.9 (11.2)	56.2 (10.3)	2.490 (0.024)
NDI (score)	22.2 (5.2)	19.0 (5.7)	2.186 (0.044)
HIT-6 (score)	59.9 (4.4)	52.9 (6.0)	5.454 (<0.001)

Values are presented as mean (SD).

FHP: forward head posture, NDI: neck disability index, HIT-6: six-item headache impact test.

Table 4. Comparison between relaxation approach and control groups after training (N=35)

Variable	Manual therapy group (n=18)		Control group (n=17)		t(p)
	Pretest	Posttest	Pretest	Posttest	
FHP angle (mm)	35.3 (14.2)	15.3 (11.2)	18.7 (10.9)	27.1 (12.4)	6.991 (<0.001)
Foot pressure (%)					
Left side	51.1 (4.2)	51.3 (1.7)	53.8 (6.5)	51.2 (3.1)	-1.603 (0.119)
Right side	48.9 (4.2)	48.5 (1.8)	46.1 (6.4)	48.7 (3.1)	1.672 (0.104)
Forward	42.9 (14.8)	43.7 (11.9)	44.8 (14.0)	43.8 (10.3)	-0.447 (0.658)
Backward	57.1 (14.8)	56.1 (11.9)	63.9 (11.2)	56.2 (10.3)	-1.903 (0.066)
NDI (score)	24.2 (5.9)	12.0 (5.7)	22.2 (5.2)	19.0 (5.7)	5.341 (<0.001)
HIT-6 (score)	60.3 (4.7)	44.3 (6.0)	59.9 (4.4)	52.9 (6.0)	4.723 (<0.001)

Values are presented as mean (SD).

FHP: forward head posture, NDI: neck disability index, HIT-6: six-item headache impact test.

nificantly in the decreased amount of FHP, NDI, and HIT-6 after training: the degree of FHP improved from 35.5 mm at pretest to 15.3 mm at posttest; the score of NDI improved from 24.2 at pretest to 12.0 at posttest; the score of HIT-6 improved from 60.3 at pretest to 44.3 at posttest. However, the foot pressure was not significantly different between pretest and posttest in the relaxation approach (Table 2).

The control group was found to be significantly different in amount of FHP, backward foot pressure, NDI, and HIT-6 after training compared with before training: the degree of FHP increased from 18.7 mm at pretest to 27.3 mm at posttest; the score of NDI improved from 22.2 at pretest to 19.0 at posttest; the score of HIT-6 improved from 59.9 at pretest to 52.9 at posttest; the backward foot pressure was from 63.9 percent to 56.2 percent. However, foot pressure was not significantly different the other directions except in the backward direction (Table 3). This study compared the treatment effects between relaxation approach and control groups after

training. The relaxation approach group was significantly improved in FHP, NDI, and HIT-6 compared with control group after training. However the foot pressure was not significantly different between relaxation approach and control group (Table 4).

Discussion

This study evaluated the effects of relaxation approach on head posture, static postural stability, and headache in persons with TTH. This study also provided the feasibility of effective therapeutic exercise with relaxation approaches as relaxation approach for treating the TTH. The main results of this study were as follows: first, both groups had a significant change in the amount of FHP (the relaxation approach group had a significant decrease while the control group had a significant increase in the FHP angle), NDI, and HIT-6 after training; second, A significant change was seen

in foot pressure in the backward direction after training compared with before training; third, the relaxation approach group was significantly improved in FHP, NDI, and HIT-6 compared with control group after training; lastly, foot pressure was not significantly different between relaxation approach and control groups.

Headaches worsen performance during personal activities as well as the social and working environments, ultimately leading to a reduced quality of life. TTH is the most common type of headache. Previous studies in use of manual therapy in persons with TTH have been reported. Castien *et al.* [17] evaluated the effects of manual therapy in chronic TTH with 82 participants, 41 received manual therapy and 41 received usual care by general practitioner. The manual therapy of their study consisted of mobilizations in cervical and thoracic spine, exercises and postural correction for 8 weeks and having a follow-up of 26 weeks. They reported significant differences in frequency, duration and intensity of headache. Moraska and Chandler [18] studied the effects of massage focused on relieving myofascial trigger point activity on headache disability inventory with frequency, intensity, and duration of pain in 18 persons with TTH during 6 week treatment period and 3 week follow-up. They reported that the headache frequency, pain intensity, and pain duration improved significantly after massage approaches. They suggested that the results of their study provide preliminary evidence for reduction in headache pain and disability with massage therapy that targets myofascial trigger points. Moraska *et al.* [19] studied the effects of myofascial trigger point-focused head and neck massage in headache's frequency, intensity, and duration, and self-reported of perceived clinical change of headache pain and pressure-pain threshold at myofascial trigger points in 56 persons with recurrent TTH during 6 weeks treatment (45 min/2 times/1 wk) and 4 weeks follow-up. They suggested that the myofascial trigger point release is important components in the treatment of TTH.

The results of the before mentioned studies supported the results of this study, but their studies provided passive therapeutic techniques only. This study provided the relaxation approaches as relaxation approach for 30 min per session with self-exercise at peri-neck muscles including suboccipitals, sternocleidomastoid, and upper trapezius muscles for 30 min per session. The relaxation approaches focused on myofascial release approaches on peri-cranial muscles, so the approaches were provided passively in participants. However, this study included active exercise of

the participants throughout the self-exercise such as deep neck flexor exercise, foam roller thoracic stretching, foundation exercise, and black burn exercise (Y-typed, T-typed and W-typed) for strengthening and stretching cervical and thoracic muscles. One advantage of active exercise is being able to create home exercise programs for patients by making exercise programs easier to adhere to increase participant compliance. Therefore, even though the relaxation approach used in this study was not passive exercise program only, the self-exercise in this study would be prescriptions for home exercise program because of positive improvement after training. It is another benefit to measure the head posture and neck disability compared to previous studies. One of possible causes of TTH is myofascial trigger points, muscle spasm, and fatigue at pericranial and neck areas, so this study measured directly the dysfunction of body structure and showed positive improvement of body structure such as FHP and neck disability. Relaxation in suboccipital and neck muscles would improve the dysfunction of body structure after relaxation approach in this study.

The relaxation approach of this study consisted of relaxation approaches as passive components of treatment program and self-exercises at neck and thoracic spine as active components of the program. The results of this study showed treatment with relaxation approach techniques combined self-exercise would be effective in reducing the amount of FHP, neck disability and headache impacts. This study did have several limitations. Only a small number of participants were involved in this study compared with previous studies. This study also involved shorter periods of 4 weeks compared with previous studies taken from 6 to 8 weeks. This study did not measure follow-up training as well. Future studies will need to involve possible solutions of these limitations.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

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